HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program	Upper Columbia River Spring-run Chinook Salmon - White River Supplementation Program
Species or Hatchery Stock:	Spring Chinook Salmon *Oncorhynchus tshawyscha*
Agency/Operator:	Public Utility District No 2 of Grant County, Washington Department of Fish and Wildlife, Yakama Nation, United States Fish and Wildlife Service
Watershed and Region:	Wenatchee Watershed Upper Columbia Region
Date Submitted:	9/15/09
Date Last Updated	9/15/09

SUMMARY

The goal of this program is to prevent the extinction of, to conserve, and to aid in the recovery of the naturally spawning Wenatchee spring Chinook salmon population in the White River. This action also partially meets the mitigation responsibilities of Grant County Public Utility District No. 2 (Grant PUD) for unavoidable losses associated with the operation of the Priest Rapids Hydroelectric Project (consists of Wanapum and Priest Rapids dams) while factors that limit the recovery of the Wenatchee spring Chinook salmon population are remediated. The integrated recovery program is funded by Grant PUD. Overall program direction is provided in the Biological Opinion approved for the Priest Rapids Hydroelectric Project, the Section 10 permit #1592 issued for scientific research/– artificial production (expires May 31, 2010), and the Priest Rapids Project Salmon and Steelhead Settlement Agreement. As directed by program documents, the Priest Rapids Coordinating Committee Hatchery Subcommittee has been formed to oversee the planning and implementation of this and Grant PUD's other mitigation supplementation programs.

White River spring Chinook are part of the Upper Columbia River (UCR) Spring Chinook Salmon Evolutionarily Significant Unit (ESU) which was listed as endangered under the Endangered Species Act (ESA). Supplementation is being used as a risk aversion measure to increase the number of returning adults and to decrease the risk of extinction. It is one of several components of the recovery strategy for Upper Columbia River spring-run Chinook. Concurrent habitat, harvest, and hydro-system protection and improvement strategies are being employed throughout the region.

Since 1997, the White River spring Chinook supplementation program has been in a juvenile-based captive brood phase. The source for broodstock is 135 (or fewer) natural origin eggs or fry that are collected from up to 50 redds in the river. The last collection will occur during 2009. After rearing in captivity to adulthood, these adults are spawned and their progeny are grown to smolt size for release back into the White River. In the future, the program will transition into an adult-based supplementation phase. Starting as soon as 2012, White River origin adults will be trapped and spawned to produce the 150,000 smolts targeted for release. This release level is anticipated to result in the average return of approximately 698 (0.00465 smolt-to-adult return ratio (SAR)) adult spring Chinook salmon to the White River each year.

The facilities required for both the captive brood and adult-based supplementation phases have the following functions: rearing captive brood, capturing adults, holding adults, rearing pre-smolts, acclimating through the winter, and acclimating at final release locations. Captive brood rearing has been done at a private hatchery in Western Washington up until 2008-2009 when fish were transferred to Little White Salmon National Fish Hatchery. A release location on the White River has been identified for acclimation, but long-term facilities have not been built. Temporary acclimation sites in the White River, net pens in Lake Wenatchee, and direct releases into the White River will be used until facilities are operational.

Brood collection is an important part of the supplementation process. Capture of White River origin adults that are characteristic of the natural population is a program objective. Local acclimation is another important program component. The program goal is to hold pre-smolts in natural conditions in the White River basin for several months prior to release. Acclimation, and other facilities, will be designed and operated to improve smolt-to-adult survival rates, minimize straying, minimize impacts to naturally produced fish, and to fit into the existing watershed landscape.

Program managers have developed quantitative program objectives for the hatchery and associated monitoring and evaluation (M&E) objectives. These objectives will serve as the guidelines for the development and evaluation of hatchery mitigation programs, risk assessment, development of monitoring and evaluation plans, and the basis for adaptive management. Program effectiveness in several general categories will be measured: legal mandates, conservation of the naturally spawning population, genetic characteristics, and facility operation. An M&E plan is proposed that will collect the data necessary to measure program performance. The M&E plan conforms to the objectives and data collection protocols that were generated from Chelan and Douglas PUDs' Habitat Conservation Plans.

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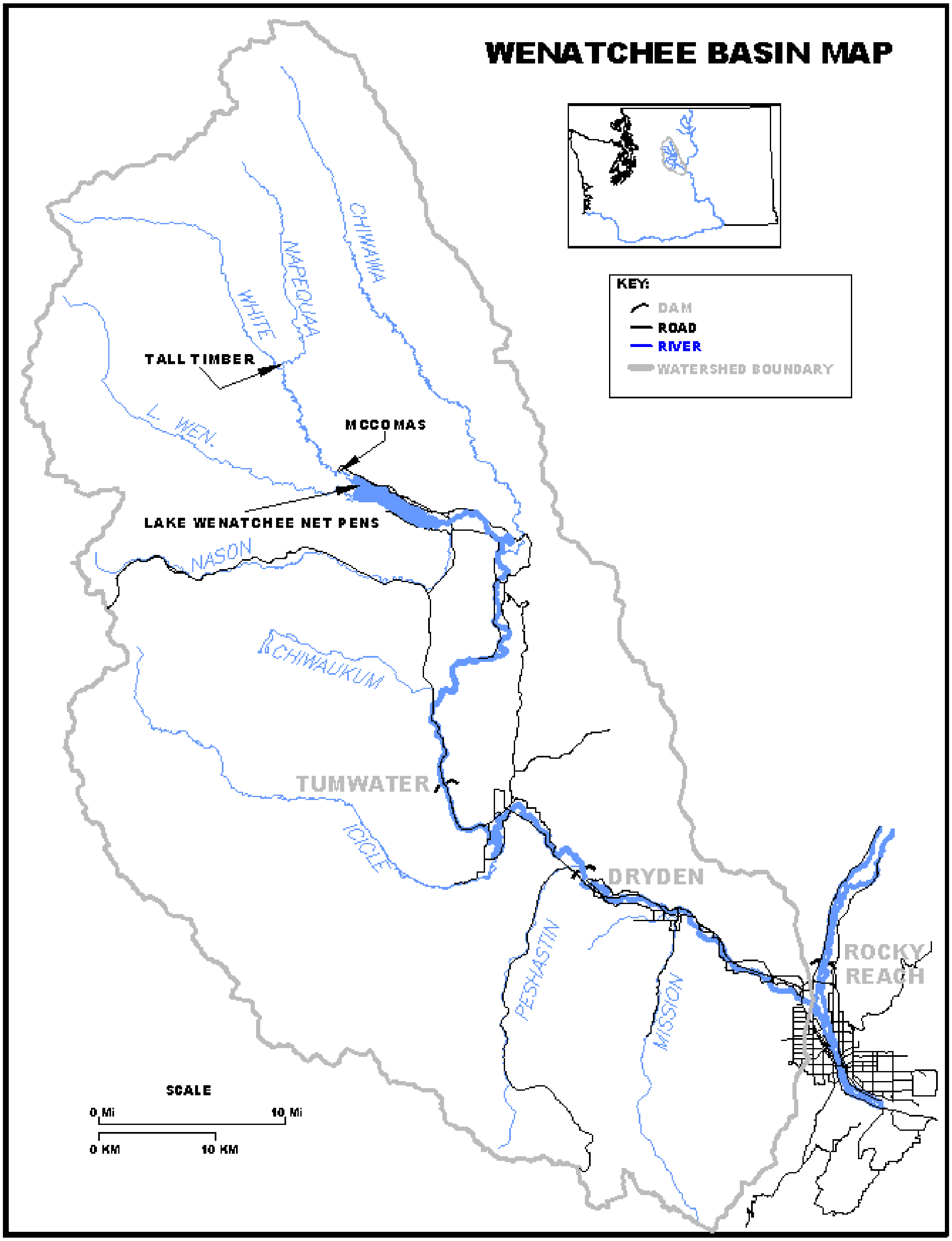


Figure 1. Map of the Wenatchee Basin highlighting sites in or near the White River.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of program.

Upper Columbia River Spring-run Chinook Salmon - White River Supplementation Program.

1.2) Species and ESA status.

Spring Chinook salmon, *Oncorhynchus tshawytscha*, endangered.

1.3) Responsible organization and individuals.

Indicate lead contact and on-site operations staff lead:

Agency: Grant PUD
Name (and title): Russell Langshaw – Fisheries Scientist
Address: P.O. Box 878, Ephrata, WA. 98823
Telephone: 509 754-5088x2170
Fax: 509 989-7305
Email: Rlangsh@gcpud.org

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

- Washington Department of Fish and Wildlife (WDFW): Jeff Korth - Co-manager and Priest Rapids Coordinating Committee, Hatchery Subcommittee (PRCC HSC) member.
- Confederated Bands and Tribes of the Yakama Nation (YN): Tom Scribner - Co-manager and PRCC HSC member.
- Confederated Tribes of the Colville Indian Reservation (CCT): Kirk Truscott - Co-manager and PRCC HSC member.
- Confederated Tribes and Bands of the Umatilla Indian Reservation (CTUIR): Carl Merkle - Co-manager and PRCC HSC member.
- National Marine Fisheries Service (NMFS): Kristine Petersen - Administration of the Endangered Species Act and member of the PRCC HSC.
- U.S. Fish and Wildlife Service (USFWS): William Gale – Administration of the Endangered Species Act and member of the PRCC HSC.
- USFWS, Little White Salmon/Willard National Fish Hatchery Complex (NFH): Speros Doulos - Complex Manager. Contractor to Grant PUD.
- Ross & Associates, Inc.: Elizabeth McManus – PRCC HSC facilitator; contractor to Grant PUD.
- Sea Springs Co: Greg Ferguson – HGMP production and facilities planning consultant to Grant PUD.
- Jacobs Engineering: David Allison – Facilities engineering consultant to Grant PUD.

1.4) Funding source, staffing level, and annual operating costs.

Funding: Public Utility District No.2 of Grant County (Grant PUD – see Attachment 5 for a list of acronyms). White River program costs to June of 2009 are shown below.

Table 1. White River Hatchery program costs as of June, 2009.

Activity	Cost	Subtotal
Captive Brood Collection/Rearing/Incubation		$ 15,812,446
Chelan PUD	$ 4,172	
WDFW	$ 374,873	
USFWS	$ 1,486,009	
AquaSeed	$ 13,947,392	
Site Water Evaluation		$ 112,812
M&E		
Yakama Nation	$ 106,558	$ 631,334
WDFW (technical services)	$ 52,639	
WDFW (captive broodstock)	$ 426,846	
NMFS (Fish Passage Center)	$ 45,290	
Consulting		$ 674,014
Misc. Materials/Directs		$ 195,134
Grant PUD Labor		$ 165,921
TOTAL		**$ 17,591,661**

1.5) Location(s) of hatchery and associated facilities.

The program is currently in a juvenile-based captive brood phase. Eggs or fry are removed from the White River and reared to adulthood in order to produce second generation smolts that are planted back in the river via acclimation. Several hatchery facilities outside the Wenatchee River basin have been or are currently being used to rear the broodstock and their progeny.

Facilities:

- AquaSeed Corporation Facilities: 10420 173rd Ave. SW., Rochester, Thurston Co., WA. 98579-9644. Captive brood were reared at AquaSeed. Receiving water: 001 and 002 Black River, Water Body ID No: WA-23-1015. Captive Brood were reared and spawned at the Domsea and Carlson sites through March 2009. Captive brood progeny were reared at the Domsea and Carlson sites through Brood YR 2005. No rearing currently occurs and is not anticipated to occur at AquaSeed facilities.
- Eastbank Hatchery, 13246 Lincoln Rock Road East, East Wenatchee WA 98802. Located on the east side of the Columbia River near Rocky Reach Dam, 7 miles north of Wenatchee, Washington (Water Resource Inventory Area [WRIA] 48). River mile 473. A portion of Brood YR 2004 progeny were reared at this locale and released into the White River in spring 2006. Future use of the Eastbank facility is no longer a viable consideration due to water issues and mitigation obligations in the Rock Island and Rocky Reach Dam HCPs. Eggs that are collected in the White River for the first-generation portion of the program are incubated at the Eastbank Hatchery until enough are collected to efficiently transfer them to the Little White Salmon NFH.
- Little White Salmon National Fish Hatchery complex (NFH), 56961 State Route 14, Cook, WA 98605. Located at river mile 1 on the Little White Salmon River (WRIA

29). Captive brood progeny were reared at Little White Salmon NFH beginning with Brood YR 2005. Transition of the captive brood rearing began in July 2008 and the full transition was completed in March 2009. It is anticipated that all future captive brood rearing and smolt production will occur at the Little White Salmon NFH.

- Tall Timbers Ranch on the White River (WRIA #45). River mile 11. Small, temporary tanks were used at Tall Timbers during 2004 and 2005 to acclimate/release a small number of yearlings. During 2006 and 2007 approximately 1,600 yearlings and 139,000 subyearlings were released downstream of Tall Timbers, respectively. During 2010 a feasibility trial will be conducted in a natural side channel to evaluate the use of natural features to acclimate fish.
- McComas on the White River at river mile 2, Site evaluations are being conducted and conceptual designs are being developed for a long-term acclimation facility at this location. It is anticipated that up to 150,000 yearlings will be reared/acclimated at this location from November to May of each year.
- Other acclimation methods will also be evaluated. During 2010, a feasibility trial is planned for a natural back-eddy at the McComas site to test in-river acclimation. A net seine fixed in position in the river will confine Chinook pre-smolts during the acclimation period. Also, a natural side channel with a net barrier at Tall Timbers may be used for temporary, short-term acclimation higher in the watershed. If successful, these acclimation techniques could be used at other locations.
- Lake Wenatchee net pens. The pen complex is located on the west end of the lake near the mouths of the White River and Little Wenatchee. Approximately 69,000 and 89,000 yearlings were released from the net pens in 2007 and 2009, respectively. It is anticipated that most fish will be acclimated at this location until the McComas facility can be developed.

Transition to an adult-based supplementation phase will occur as progeny from the last egg/fry removal are released. Facilities for brood capture, adult holding, rearing, and acclimation/release have not yet been finalized (see section 5).

1.6) Type of program.

Integrated Recovery Program (see Attachment 1 for definitions).

Special decision criteria for captive broodstock program:
The captive broodstock approach is broadly recognized as an extreme measure and is generally employed only when populations are dangerously close to extinction and when inaction may lead to continued population decline (Flagg and Mahnken 1995, Hart et al 1992, NMFS 1999a, NMFS 1999b). Intensive fish culture programs of this type are monetarily costly, largely untested, and may pose some poorly understood risks to the resource. Consequently, it is important that mechanisms be in place to assess performance of the project relative to expectations and to guide decisions concerning the future direction of this program. In particular, there is interest in a method by which the duration and appropriate end point for the captive broodstock phase of the White River spring Chinook recovery program can be recognized. The following decision framework

provides a tool by which the efficacy of the captive broodstock program can be assessed by the PRCC HSC and NMFS.

The following assumptions are made concerning the decision making process for the captive broodstock phase:

- Biological fish culture criteria have been developed, documented and implemented.
- Performance criteria have been developed and documented.
- Facility design criteria have been developed, documented, and implemented.
- A robust M&E plan has been initiated and funded at levels agreed to be adequate to assess appropriate response variables.

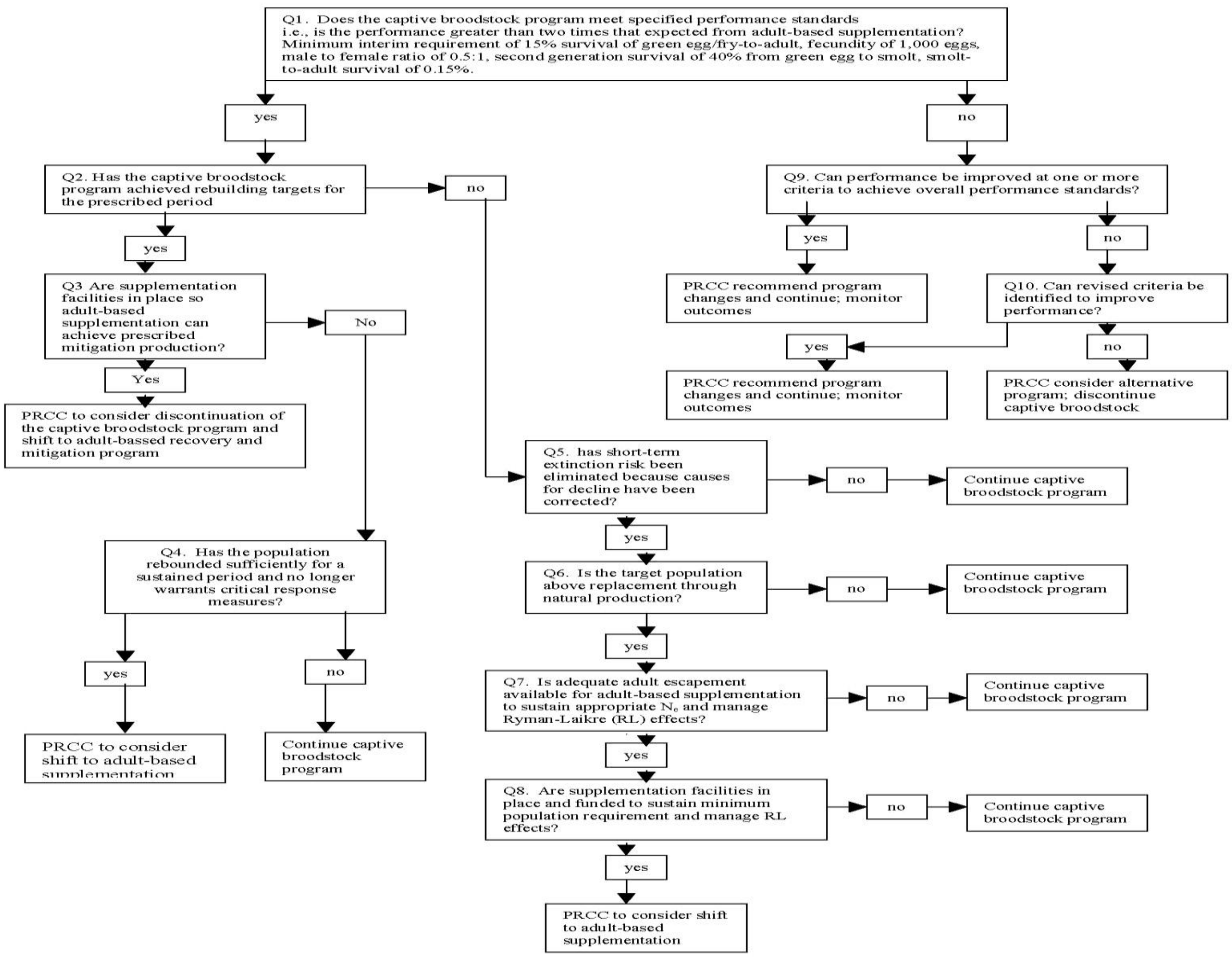


Figure 2. Decision criteria for the White River Hatchery program.

A draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009 - see section 3.2) describes a proposal to operate the Wenatchee hatchery programs with two components. A conservation component is intended to rebuild the natural population using a fully integrated broodstock collection program and a “safety net” stepping stone component that completes the full production level of the program, is genetically linked to the natural population, and guards against catastrophic run failure.

The White River hatchery program is proposed to be operated as a conservation program for a maximum of two generations (10 years). After that, based on monitoring results, a safety net component would be incorporated.

Adult returns are proposed to be managed at Tumwater Dam such that conservation fish are allowed to spawn naturally at appropriate levels, are collected for broodstock for the safety net program, or are used in another beneficial manner.

1.7) Purpose (goal) of program.

Conservation/Preservation: The purpose of the program is to increase the number of natural spawners in the White River and reduce short-term extinction risk for the Wenatchee River population of spring Chinook salmon. The goal of this program is to prevent the extinction of and conserve the naturally spawning Wenatchee spring Chinook salmon population in the White River, and to achieve partial mitigation for unavoidable losses associated with the operation of Wanapum and Priest Rapids hydroelectric projects, while factors that limit the recovery of the population are remediated. The White River is one of 5 major spawning areas (MaSa) of the Wenatchee population which in turn is one of 4 major population groups in the Upper Columbia ESU. Recovery of the White River spawning aggregate supports the restoration goals for the Wenatchee population and the ESU (Recovery Plan, UCSRB 2007).

The conservation/preservation program has been incorporated as part of a suite of mitigation actions listed in the Biological Opinion issued for the Priest Rapids Project by NMFS on February 1, 2008 (Biological Opinion, NOAA 2008). As recovery of natural production occurs, the responsible parties (see below) will modify the program to meet the continuing mitigation responsibilities related to unavoidable losses associated with operation of the Priest Rapids hydroelectric complex.

1.8) Justification for the program.

This program was originated, and is proposed to be continued, to reduce the risk of extinction for naturally spawning, Wenatchee River spring Chinook. The population has been in decline since data started being recorded and numbers have dropped below those thought to be required for a viable spawning aggregate. Supplementation is one of the techniques being implemented to halt this decline and offers the potential to produce relatively rapid increases in adult return numbers. The supplementation program is designed to trap and spawn White River origin adults to produce the 150,000 smolts targeted for release. This release level is anticipated to result in the average return of approximately 698 (0.00465 smolt-to-adult return ratio (SAR) from data collected for the Chiwawa supplementation program) adult spring Chinook salmon to the White River each year.

The figure below, from the NOAA Interior Columbia Technical Recovery Team (http://www.nwfsc.noaa.gov/trt/trt_documents/wenatchee_river_chinook07.pdf) shows the abundance trend for both natural origin and total spawners for the entire Wenatchee River spring Chinook salmon population. Data includes both hatchery, except Icicle, and natural origin fish. The Wenatchee population reached critical levels in the late 1990's and natural-origin spawning numbers remain severely depressed.

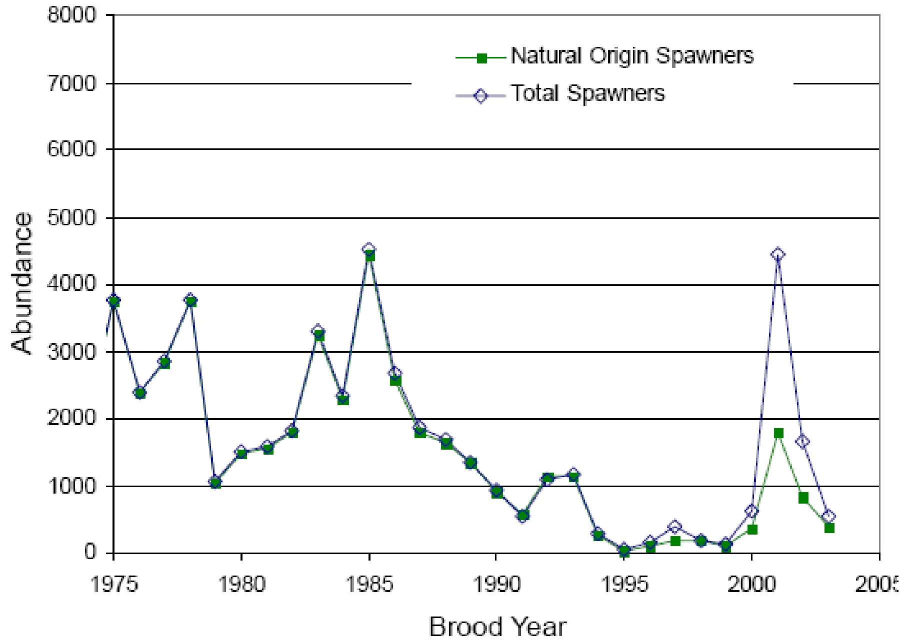


Figure 3. Abundance trend for both natural origin and total spawners for the entire Wenatchee River spring Chinook salmon population (see Table 8).

The White River Major spawning Area follows the trends of the Wenatchee spring Chinook population. Natural origin spawner numbers reached single digits in the late 1990's (see section 2.2.2) and remain below minimum thresholds (see section 1.6).

The White River major spawning area is within the Upper Columbia River (UCR) spring-run Chinook salmon Evolutionarily Significant Unit (ESU) which is listed as Endangered (Federal Register Vol. 64, No. 56, March 24, 1999). This ESU includes all naturally spawning populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. McClure et al. (2003) further delineated the ESU, describing three populations: Wenatchee River (except Icicle Creek), Entiat River, and the Methow River. The White River aggregation is the most genetically unique among those spawning in tributaries within the ESU (Utter et al. 1995, Ford et al. 2001, McClure et al. 2003). An updated genetic evaluation (microsatellite analysis) of the White River aggregation and other spawning aggregates in the Wenatchee basin began in 2004 and is supported through a natural and hatchery origin reproductive success study funded by Bonneville Power Administration (BPA Project No. 2003-0399-00). Analysis of 2004 and 2005 reproductive success data indicates that the White River spawning aggregate continues to represent a distinct sub-population in the Wenatchee River basin (Murdoch et al. 2006). Supplementation using artificial propagation of the White River, Nason Creek, Chiwawa River, Twisp River, Methow River, and Chewuch River stocks was determined to be essential to recovery and these hatchery programs are included in the ESU.

The survival efficiency gained through captive broodstock between the eyed egg and adult life history stage while reared in captivity (i.e., program goal = 30%) is expected to increase the quantity of adults for spawning when compared to that realized in the natural environment or to traditional adult-based supplementation hatcheries. When eggs are collected from captive brood adults, the second generation progeny (F2) are expected to benefit from the additional survival advantage during the juvenile life history phase (about 65% vs. about 15% when compared to natural production) before being released as smolts for natural migration to the ocean and subsequent return. The rapid amplification gained through survival efficiencies while in the hatchery environment is intended to result in a greater quantity of spring Chinook salmon returning to the White River for natural spawning.

The program is expected to transition from a captive brood-based program to an adult-based supplementation program as the naturally spawning target population becomes more robust and the risk of extinction is lessened or the program is determined to fail to meet performance standards as determined by the PRCC under the Biological Opinion. The transition into adult-based supplementation is expected to occur after 2009, but may differ depending on the success of the captive broodstock program, the rate of recovery, and the availability of adult-based supplementation facilities.

The Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (Recovery Plan; UCSRB 2006)) (see Section 3.1) proposes recovery criteria for UCR spring Chinook based on information contained in Interior Columbia Basin Technical Recovery Team (ICBTRT 2004b) and Ford et al. (2001). The Recovery Plan suggests that recovery requires reducing or eliminating threats to the long-term persistence of populations, maintaining widely distributed populations across diverse habitats of their native ranges, and preserving genetic diversity and life history characteristics. Successful recovery of the species means that populations have met certain measurable criteria associated with viable salmonid populations. The recovery plan focuses on four viable salmonid population (VSP) parameters: abundance, productivity, spatial structure, and diversity of naturally produced fish.

The White River recovery effort is expected to complement supplementation programs in other key tributaries of the Wenatchee River population by enhancing population metrics for the Wenatchee River basin spring Chinook population. The White River supplementation program is designed to support recovery consistent with the following UCR spring Chinook VSP recovery criteria (UCRSRB 2006):

Abundance/Productivity:
Several criteria are required to achieve recovery of the Upper Columbia Spring Chinook ESU.

Criterion 1: The 12-year geometric mean for abundance and productivity of naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations must fall above the 5% extinction-risk (viability) curves.

Criterion 2: At a minimum, the Upper Columbia Spring Chinook ESU will maintain at least 4,500 naturally produced spawners and a spawner:spawner ratio greater than 1.0.

The Wenatchee population will maintain a 12 year geometric mean minimum number of spawners of 2,000 and a 12 year geometric mean minimum spawner:spawner ratio of 1.2.

"Because populations with fewer than 500 individuals are at higher risk for inbreeding depression and a variety of other genetic concerns (McClure et al. 2003 discusses this topic further), the ICTRT does not consider any population with fewer than 500 individuals to be viable, regardless of its intrinsic productivity. Therefore we set the threshold level (minimum acceptable long term average spawning abundance) for the smallest category of drainages at 500 spawners (ICBTRT 2007a)."

It is anticipated that the supplementation program in the White River will increase the abundance of spawners up to the habitat carrying capacity in the White River. However, it is likely that the productivity of the population will decrease as the population approaches or exceeds carrying capacity and as the proportion of hatchery origin spawners and proportion of hatchery origin brood increases. The supplementation program is designed to trap and spawn White River origin adults to produce the 150,000 smolts targeted for release. This release level is anticipated to result in the average return of approximately 698 (0.00465 smolt-to-adult return ratio (SAR) taken from the Chiwawa Hatchery program) adult spring Chinook salmon to the White River each year. If hatchery adults that spawn in the natural environment produce 0.5 natural origin progeny/hatchery parent, then about 349 natural origin spawners would be produced to spawn in the natural environment. This short-term demographic benefit is not without risk to the long-term productivity of the population (treated later in this document), but the short-term reduction in extinction risk is thought to out-weigh the risks to long-term fitness. However, there are considerable scientific uncertainties associated with impact to long-term fitness.

Spatial Structure/Diversity:
Criterion 3: Over a 12-year period, naturally produced spring Chinook will use currently occupied major spawning areas (minor spawning areas are addressed primarily under Criteria 4 and 5) throughout the ESU according to the following population-specific

criteria: Naturally produced spring Chinook spawning will occur within four of the five major spawning areas in the Wenatchee subbasin (Chiwawa River, White River, Nason Creek, Little Wenatchee River, or Wenatchee River) and within one minor spawning area downstream from Tumwater Canyon (Chumstick, Peshastin, Icicle, or Mission). The minimum number of naturally produced spring Chinook redds within each major spawning area will be either 5% of the total number of redds within the Wenatchee subbasin or at least 20 redds within each major area, whichever is greater.

Criterion 4: The mean score for the three metrics of natural rates and levels of spatially mediated processes will result in a moderate or lower risk assessment for naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations and all threats for “high” risk have been addressed.

Criterion 5: The score for the eight metrics of natural levels of variation will result in a moderate or lower risk assessment for naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations and all threats for “high” risk have been addressed.

In addition to survival enhancement of the listed spring Chinook population, program justification includes other cultural, socio-economic, and ecological benefits. For example, the commercial value of Columbia basin tribal, commercial, and recreational fisheries is estimated by the Independent Economic Analysis Board (IEAB 2005) as contributing “about $142 million total personal income annually to communities on the West Coast.” A recovered UCR spring Chinook population can help increase that harvest, directly and indirectly. Also, general ecosystem recovery is a goal of many Columbia River Tribes, communities, and citizen groups. The benefits to other listed and non-listed species in the region are discussed in section 3.5 and in Addendum A. As stated in the Endangered Species Act (1973): “various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation;…these species of fish, wildlife, and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people.”

It is anticipated that the supplementation program in the White River will increase the spatial structure of spawners by planting hatchery fish into minor spawning areas that currently have few to no adult spawners (e.g., Peshastin Creek). Diversity may increase or decrease depending upon the amount of straying, compositing of broodstock, and local adaptation that occurs through properly run supplementation programs. There are also concerns about reduction in genetic diversity caused by using a small number of broodstock for the captive brood program.

The White River spring Chinook hatchery program will be designed to release approximately 150,000 yearling smolts annually from a newly constructed acclimation facility located on the White River. A smaller number of these fish may be released into semi-natural locations. This release level is anticipated to result in the average return of approximately 698 (0.00465 smolt-to-adult return ratio (SAR; Hillman et al. 2009)) adult spring Chinook salmon to the White River each year. The maximum returns are expected to be 2,343 (SAR = 0.01562, Hillman et al. 2009) and the lowest returns are expected to be 54 adults (SAR = 0.00036, Hillman et al. 2009). Hatchery returns will be allowed to spawn naturally when insufficient number of natural origin spawners are available. Hatchery returns may also be used in hatchery broodstock when insufficient numbers of natural origin fish are available. Hatchery returns that exceed those needed for broodstock or spawning in the White River, will be used to outplant into minor spawning areas below Tumwater Dam, conservation fisheries, nutrient enhancement, or food – when fish return in number that are surplus to recovery needs.

The supplementation program is designed to trap and spawn White River origin adults. Adults will be trapped at Tumwater Dam or at the White River. Adults will be held and spawned at a facility on Nason Creek or other suitable facility. Eggs will be reared to the eyed stage at the Nason facility and then transferred for final incubation to, and juveniles reared at the Little White Salmon National Fish Hatchery or other suitable location. Pre-smolts will be acclimated throughout the winter and spring at an acclimation facility or semi-natural habitats on the White River, or net pens in Lake Wenatchee at the mouth of the White River.

The hatchery program will be adaptively managed as information is generated through the implementation of the M&E plan. The M&E plan was structured around the objectives of the hatchery program and is consistent with an ongoing M&E plan funded by Chelan Public Utility District.

The White River hatchery programs will have two components after the captive brood phase is completed and the supplementation program is well underway:

1) a Conservation component intended to rebuild the natural population using a fully integrated broodstock collection program, and
2) a "safety net" stepping stone component that completes the full production level of the program, is genetically linked to the natural population, and guards against catastrophic run failure..

The program will be fully conservation for at least 2 full generations, at which time transition to a combination of conservation and safety net will be evaluated. The two parts of the program would be reared separately until at least marking. Post marking they could be combined for final rearing and release, or remain separate if multiple small acclimation sites are developed in the tributary areas.

Adult returns would be managed at Tumwater Dam such that the conservation fish are allowed to spawn naturally at appropriate levels, collected for broodstock for the safety net program, or used in another beneficial manner. Adults produced in the safety net program will usually be available for other beneficial uses, but normally would not contribute to spawning upstream of Tumwater Dam.

1.9, 1.10) Performance Standards and Indicators.

Quantitative objectives for Grant PUD hatchery programs were developed and approved by the PRCC. The metrics for the program are presented in Table 2 and the quantitative objectives are presented in Tables 3 and 4. M&E objectives and metrics are presented in section 11.

Table 2. Metrics for quantitative objectives.

Metric	Definition or calculation	Why important
Release number and size (M&E objective 6)	Total number and weight of juveniles released	Necessary to assess whether or not the program is meeting mitigation production levels consistent with the Settlement Agreement.
Proportion of natural influence (PNI) (M&E objective 7)	Proportion of total selection (hatchery and natural) that is due to natural selection. Calculated as pNOB/(pNOB + pHOS) pNOB=proportion of natural origin brood in the hatchery pHOS=proportion of hatchery origin spawners in the natural environment	Helps determine size of programs, type of programs, management of hatchery broodstock, management of fish of different origins on the spawning grounds
Hatchery SAR (M&E objective 4)	Smolt-adult return rate by brood year	Necessary monitoring to assess overall hatchery smolt survival. Essential for run-forecasting and out-year mitigation requirements.
Within hatchery survival (M&E objective 6)	Survival by life stage	Necessary monitoring to assess/maximize the efficacy of hatchery rearing and will guide future hatchery rearing strategies.
Escapement (M&E objective 1)	Number of adults that spawn in the natural environment	Under escapement can harm the viability of the population and over escapement can result in lost harvest opportunity and potentially reduced productivity
Stray rate (M&E indicator 5)	Three metrics for evaluating straying: Stray 1=percentage of hatchery release that strays to non-target spawning areas, Stray 2=percentage of a non-target spawning	Straying into non-target populations has the potential to reduce productivity of non-target populations and reduce between population diversity. Strays from other programs could impact the target population.

	population that contains hatchery strays, Stray 3=percentage of non-target populations that stray into targeted population	
Relative productivity (M&E indicators 1 and 4)	Productivity of hatchery and natural origin fish in the hatchery and the natural environment across generations. This includes: freshwater productivity (e.g., The number of juveniles / redd or juveniles / spawner. Juveniles may be measured at different life-stages such as parr, emigrants, or smolts), Hatchery and natural origin adult recruits/spawner and hatchery smolt-to-adult recruitment (SAR).	Critical factor in evaluating whether a hatchery is contributing to or reducing natural production. Evaluating productivity at different life-stages also helps assess the time and place of achievement of objectives (i.e. assess potential mining of adults).
Genetic Diversity (M&E indicator 3)	Allele frequency. Effective population size. Divergence among MSAs.	Genetic diversity within and between populations is associated with increased productivity and long-term fitness.
Biological characteristics of adult hatchery and natural origin offspring (M&E objectives 2 and 3)	Size at age, age at maturation, return and spawn timing, sex ratio, fecundity, egg size, spawn location	Manifestations of genetic and environmental differences which could impact long-term fitness, viability and productivity. Utilized as a monitoring indicator to support management decisions based on assessment of biological significance.
Harvest (M&E objective 8)	Number of fish to be harvested in all fisheries	Contributes value to commercial, subsistence, and recreational fisheries, and is important for spiritual reasons
Non-target taxa of concern (NTTOC) (M&E objective 9)	% impact to a taxon baseline abundance, size, or distribution A risk assessment will be conducted that will identify which NTTOC, if any, will be monitored and will help inform the frequency and intensity of monitoring. The containment objectives need to be consistent with	Allows for a proper balancing of target and non-target taxa benefits and costs

	HCP objectives.	
BKD concentration (M&E objective 7)	ELISA optical densities.	Reduces disease risk to the population.

Table 3 Biological goals for integrated hatchery programs that will be used for evaluation of different hatchery strategies and presentation in HGMPs. PNI=proportion of natural influence, EN= spawning escapement of natural origin fish, K=the minimum number of spawners to produce the asymptotic number of recruits, R=recruitment productivity in recruits per spawner, A=number of adults, H= hatchery, E=spawning escapement (hatchery and natural origin fish combined), N=natural origin recruits, D= donor population, Ne=effective population size, RH=recruitment of hatchery fish, RHN=recruitment of hatchery fish in the natural environment, RN =recruitment of natural origin fish in the natural environment, B = hatchery broodstock, P = prespawn mortalities.

HGMP	Release # and size (see table 3)	PNI[1]		Genetic Diversity	Stray Rate	Relative Productivity	Biological characteristics
Spring Chinook White River	White River (150,000 @ 10-15 fish/pound)	0.50 per MSA, 0.67 for population.		Allele freq. H = N = D Sub-population genetic distance $_{\text{year x}}$ = distance $_{\text{year y}}$ $(Ne/E)_{\text{year x}} = (Ne/E)_{\text{year y}}$	<5% Between populations, <10% within population	RH*RHN*RN> RN*RN*RN (more great grandchildren if a fish is taken into hatchery than left to spawn in the natural environment).	H=W (see table 1)

BKD Concentration	Broodstock	Escapement	Hatchery Replacement Rate	Natural Replacement Rate	Reproductive Success	Harvest[1]
<Baseline values	100	217 White upstream of Tumwater Dam	>Expected value (from BAMP)	>Non-supplemented population.	>0.85	≤A-K-B-P

[1] Prioritize harvest of hatchery origin fish to meet PNI objectives

Table 4. Survival standards of spring Chinook salmon within hatcheries for PRCC hatchery programs.

	Collection to spawning		**Unfertilized egg-eyed**	**Eyed egg-ponding**	**30 d after ponding**	**100 d after ponding**	**Ponding to release**	**Transport to release**	**Unfertilized egg-release**
	Female	**Male**							
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

1.11) Expected size of program.

Up to 150,000 artificially produced smolts are planned to be released annually from White River acclimation sites and are a component of Grant PUD's overall UCR spring Chinook mitigation obligation for the operation of the Priest Rapids Projects. The 150,000 smolt production for the White River is based upon the expected smolt-to-adult survival (SAR) for hatchery spring Chinook in the Wenatchee basin, preliminary historic adult intrinsic spawner capacity estimates derived from data provided in the Draft Viability Criteria for Application to Interior Columbia Basin Salmonid ESU's Report (2007a), habitat capacity estimates summarized in Ford et al (2001), and historical adult escapement to the White River. It is estimated that 698 adults will be produced during the adult-based supplementation phase, and a lesser but less certain number of adults from the captive brood phase.

Proposed annual broodstock collection level:

Captive Brood Phase:

No adults will be collected. Up to 1,200 White River origin eggs/fry for a 150,000 smolt release will be collected from the White River spawning aggregation for captive brood rearing (updated from 1000 as described in the BAMP).

Adult-based Supplementation Phase:

Approximately 100 adults are required to achieve the 150,000-smolt (plus 10%) production objective.

Proposed annual fish release levels.

Maximum number by life stage and location. Use standardized life stage definitions by species presented in Attachment 2.

Table 5. Proposed annual fish release levels and locations.

Life Stage	Release Location	Annual Release Level
Eyed Eggs	White River, Wenatchee River Basin	
Unfed Fry	White River, Wenatchee River Basin	
Fry	White River, Wenatchee River Basin	
Fingerling	White River, Wenatchee River Basin	Up to 200,000[1] (years 2007 – 14)
Yearling	White River, Wenatchee River Basin	Up to 150,000

[1]Fingerling spring Chinook above yearling program available for planting in the White River. Exact survival rates are unpredictable and can result in collection of too many first generation broodstock. Current protocols are that excess broodstock will be spawned and offspring will be released as fingerlings. Fingerling spring Chinook can be F1 or F2 progeny.

1.12) Current program performance.

The program has produced a net increase in the total number of smolts migrating from the White River system.

The survival rate for White River captive broodstock held from eyed egg to mature spawner has ranged from 4% to 72% and averaged 37.2% for the brood years for which complete data are available (see section 9.2.1). An average survival rate of 34% was attained for three stocks previously held for captive brood including Nason Creek, Twisp River and White River for brood years 1997 –2001 (Murdoch and Hopley 2005). The survival goal for eyed egg-to-mature adult is 30% for captive broodstock.

Releases of less than 3,000 F2 progeny have occurred in 2004-2006, with larger releases beginning in 2007, as detailed in section 10.

To date, approximately 483,623 spring Chinook have been released from the White River spring Chinook supplementation program. Prior to 2009, no fish released from the program were observed at Tumwater Dam. During 2009, fifty-four fish from the program have been observed at Tumwater Dam. Contribution by brood year will be confirmed with tag and scale information but preliminary analysis indicates there were 19 adults, 23 jacks, and 12 mini-jacks observed from three brood years (Table 6).

Actual post release survival information is limited. A Cormack-Jolly-Seber model (Skalski et al. 1998) was used to develop reach survival estimates for brood years 2006 and 2007. During 2008, approximately 142,033 yearling smolts were released directly into the White River. There were 29,880 fish PIT-tagged from this release group for this brood year and recapture information was used to estimate emigration survival of 3.8 (0.8 SE) percent from release to detection at McNary Dam (Table 6). During 2009, approximately 87,671 yearling smolts were acclimated and released from net pens into Lake Wenatchee. There were 39,773 fish PIT-tagged from this release group for this brood year and recapture information was used to estimate emigration survival of 8.3 (1.6 SE) and 9.5 (1.0 SE) percent from release to detection at McNary Dam for the control and treatment groups respectively (Table 6).

Significant releases did not occur until brood year 2005 so significant numbers of adults were not expected to begin returning until 2009. Thus, smolt-to-adult ratio (SAR) information for the program is limited. During 2003 through 2005, small groups of fish were acclimated and released into the White River (Table 6). No fish were observed after these releases but the groups were small and the fish were in relatively poor condition. During 2006, approximately 63,779 yearling smolts were acclimated and released from net pens in Lake Wenatchee. There were no jacks observed at Tumwater Dam from the 2005 brood year. During 2009, there were 19 adults observed at Tumwater Dam and it is expected that they all belong to the 2005 brood year. There is a possibility that some of the fish returning during 2009 are age-5 adults and some age-5 adults could return next year, however it is unlikely to be a significant number. Thus the 0.03% SAR (Table 6) for brood year 2005 should be considered preliminary and conservative, but it is unlikely to increase significantly.

In conclusion, post release survival information for the White River spring Chinook supplementation program is limited. Data on emigration survival will continue to be collected and SAR information will improve as adults return from more recent releases.

Table 6. Performance data for the White River captive brood program. Reach survival estimates and observations at Tumwater Dam for the White River spring Chinook supplementation program (brood years 2002-2007). Observations at Tumwater Dam are a combination of adults, jacks and minijacks.

Brood year	Release strategy	Release number	Reach survival estimate (% and S.E.) Release to McNary Dam	Migration year - observations at Tumwater Dam 2004	2005	2006	2007	2008	2009 - through Aug 18	SAR (%)
2002	Acclimation tanks in WR	2,589	--	0	0	0	0	0	0	0
2003	Acclimation tanks in WR	2,096	--	N/A	0	0	0	0	0	0
2004	Acclimation tanks in WR	1,639	--	N/A	N/A	0	0	0	0	0
2005	Net pens	63,779	--	N/A	N/A	N/A	0	0	19	0.03
	Direct to WR-subyearling	139,644	--	N/A	N/A	N/A	0	0	22	N/A
2006*	Direct to WR-yearling	142,033	3.8 (0.8)	N/A	N/A	N/A	N/A	0	1	N/A
	Net pens	87,671	8.3 (1.6) - control 9.5 (1.0) - treatment	N/A	N/A	N/A	N/A	N/A		N/A
2007**	Direct to Lake Wenatchee	44,172	--	N/A	N/A	N/A	N/A	N/A	12	N/A

* BY2006 reach survival estimates are based on 29,880 PIT-taged fish

** BY2007 reach survival estimates are based on 39,773 PIT-taged fish

1.13, 1.14) Project schedule.

The following summarizes the timing of past, present, and future program related activities. This schedule may change as a result of unknowns associated with permitting and facilities development issues.

<u>Program directives and reviews</u>:

- Biological Assessment and Management Plan: Mid-Columbia River Hatchery Program (BAMP 1998): completed in 1998.
- Biological Opinion for ESA Section 7 Consultation on Interim Operations for the Priest Rapids Hydroelectric Project (NOAA 2004): 1998-2004.
- Final Environmental Impact Statement for the Priest Rapids Hydroelectric Project Washington (FERC 2006): 2006.
- Priest Rapids Salmon and Steelhead Settlement Agreement (SSSA 2006) between Grant PUD, State and Federal Agencies and Indian Tribes: signed in 2006 and 2007.
- Environmental Assessment of a NOAA's National Marine Fisheries Service Action to

Issue Permit 1592. October 2006.
- Section 10(a)(1)(A) permit for the Upper Columbia River Spring Chinook Salmon White River Supplementation Program. April 13, 2007.
- Priest Rapids Hydroelectric Project FERC License. April 17, 2008.
- Columbia Basin Hatchery Scientific Review Group (HSRG) review: 2009.

Permitting:
- Existing ESA authority, Section 10 Take Permit #1592: valid from 2007-2010.
- HGMP: 2003-2008.
- National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA): 2007-2009.
- Future ESA authority, Section 10 Take Permit: expected to be received in 2010. The HGMP and NEPA processes are part of the Section 10 permit application. If the ESA evaluation process is not completed by 2010, an extension of the existing take permit #1592 may be needed.
- Water rights, JARPA, land use, and construction permits: 2007-2011. These permits are site specific and the application process can begin after locations are selected and conceptual designs are completed.
- Operating permits [WDFW fish transfer permits and National Pollution Discharge Elimination System permit (NPDES)]: required as each facility begins operation.

Monitoring and Evaluation:
- Adult monitoring: started in the 1950s by Chelan PUD and USFWS.
- Juvenile monitoring: added in 2007.

Site location and construction:
- Site evaluations for all facilities components: 2006-2011.
- Upriver, short-term acclimation sites: if feasible, used as soon as possible.
- Overwinter acclimation/rearing sites: if feasible, used as soon as possible.
- Brood capture method: testing as soon as 2011, full operation a year later.
- Brood holding/incubation sites: testing as soon as 2011, full operation a year later.

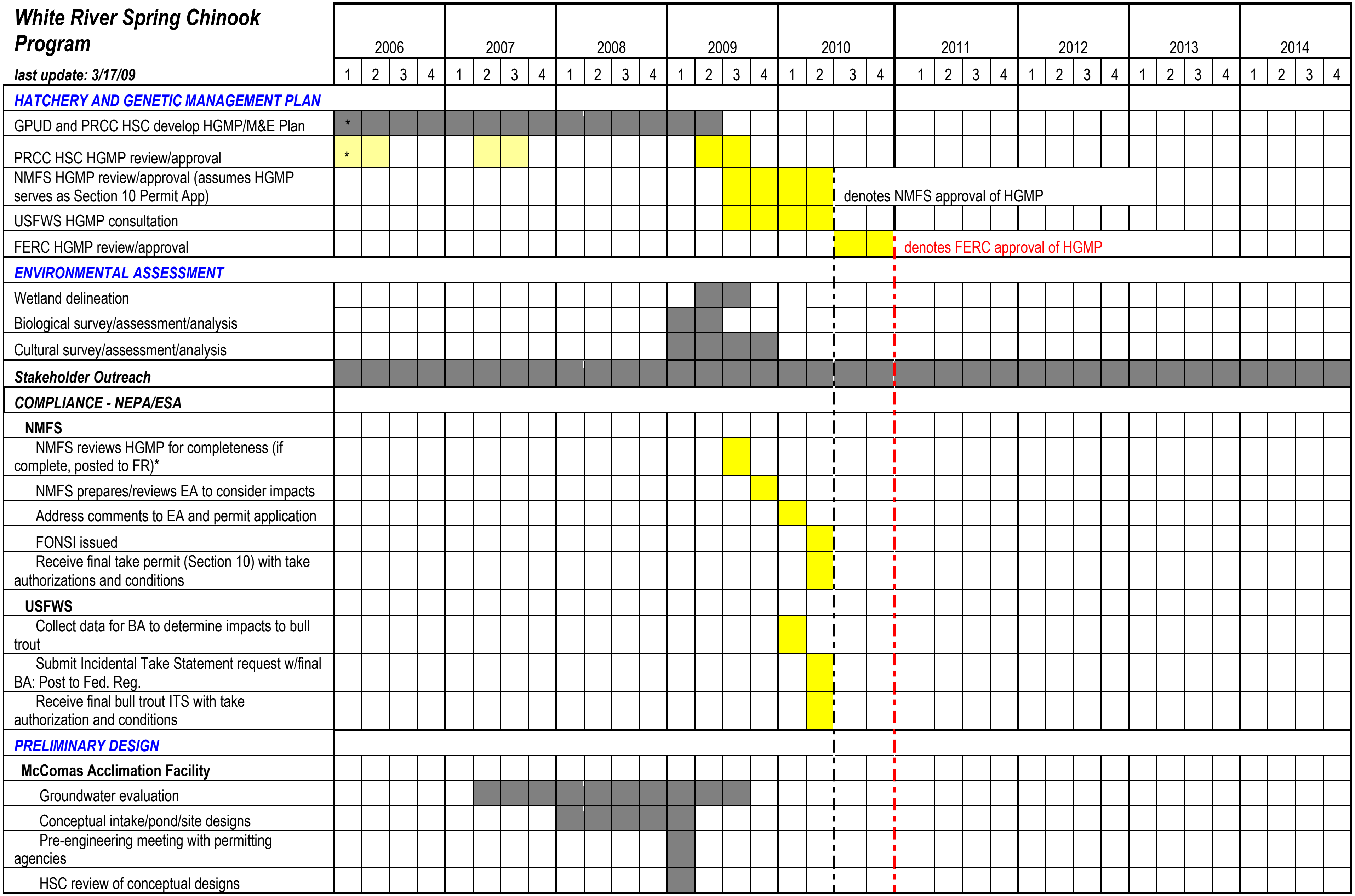
Operation:
- Egg/fry capture: 1997-2009. Insufficient numbers of egg/fry were collected for the captive brood phase during 1997 to 2001 (none collected for 1999 and 2001). The PRCC HSC determined that the captive broodstock program would begin with the 2002 egg/fry collection due to sufficient broodstock to reach smolt production needs.
- Smolt release, captive brood source releases: began in 2004 and will end sometime after 2014.
- Adult brood capture: trapping may need to begin by 2012.
- Smolt release, adult brood capture source: test group released as soon as 2014, followed by full operation a year later.
- Adult management may occur by 2010 to address overall escapement to the White River, consistent with spawn escapement objectives and PNI values currently being

discussed between Joint Fishery Parties (JFP).

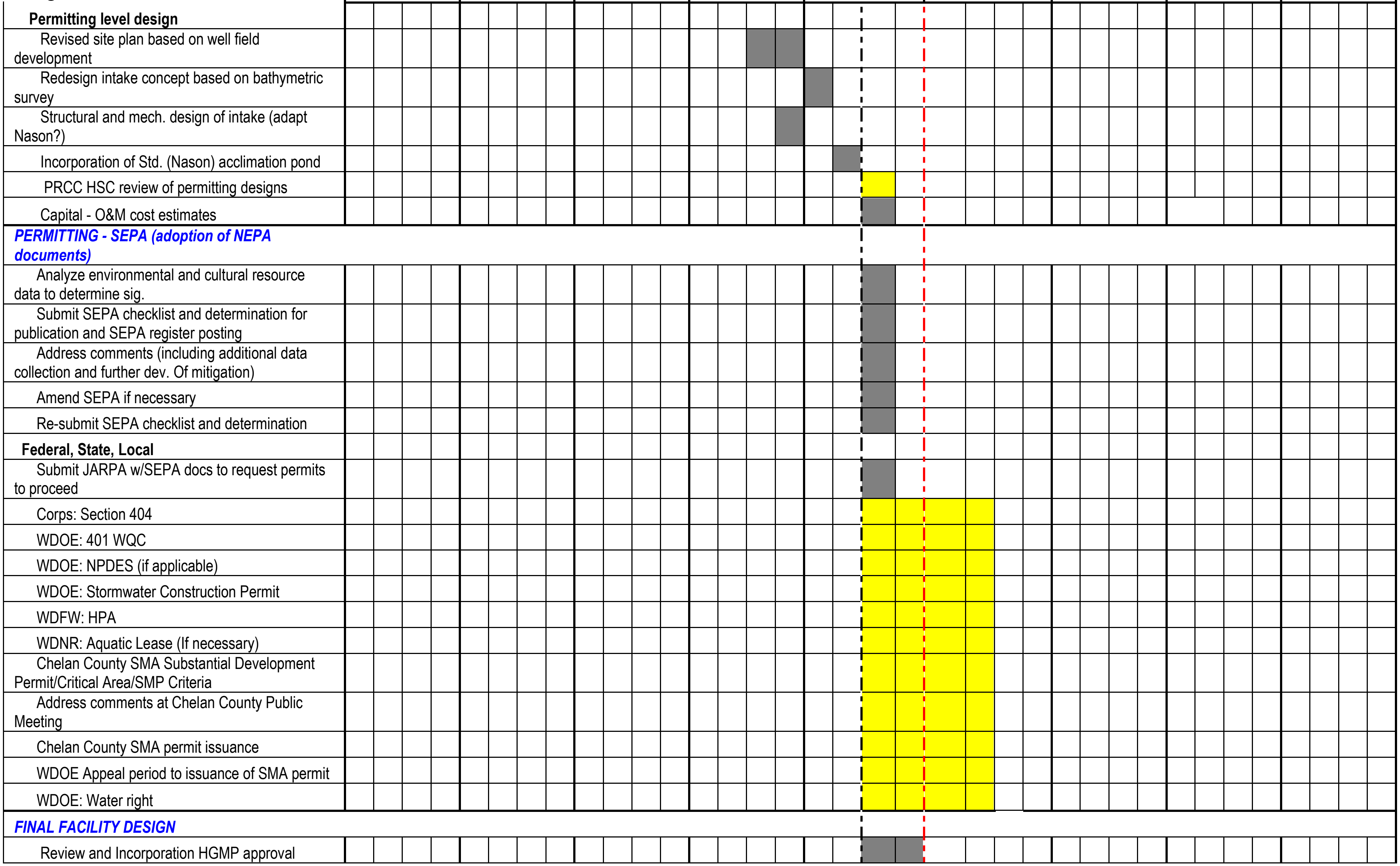
Recovery efforts will continue until the White River major spawning area is recovered (see section 1.6, performance standard 2.5). The recovery timeframe goal listed in the Upper Columbia River Salmon, Steelhead, and Bull Trout Recovery Plan (UCRSRB 2006) is 10 to 30 years.

The implementation schedule is provided below. The HSC will work to truncate the schedule where appropriate.

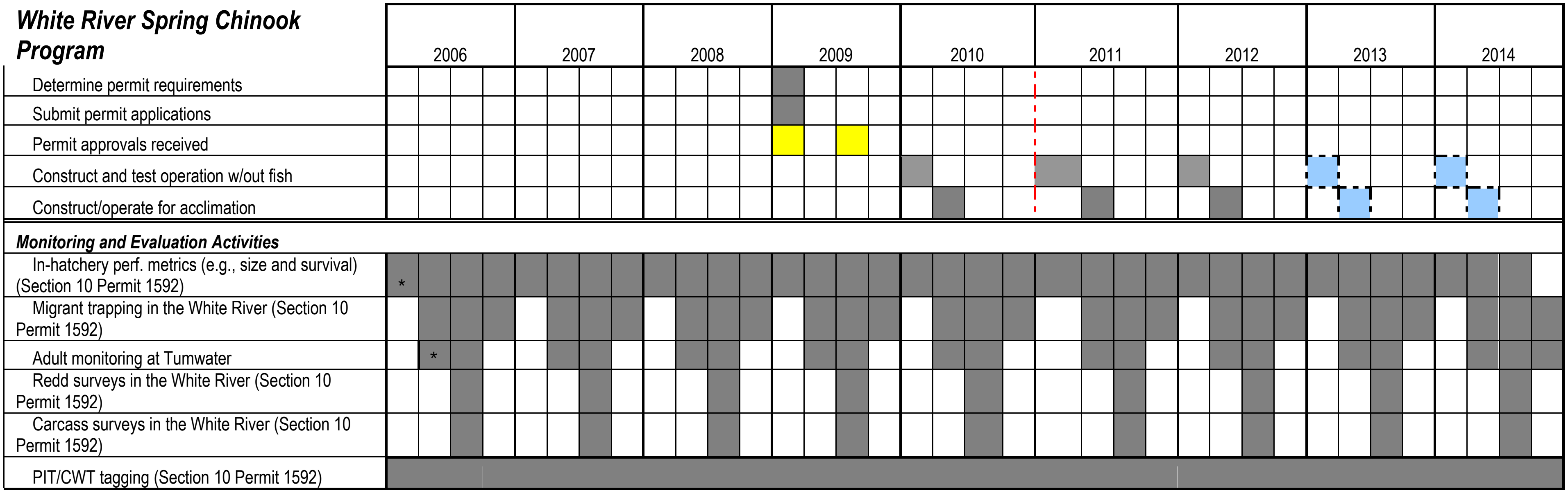
Figure 4 (below). Schedule of activities for the White River spring Chinook Hatchery program.


White River Spring Chinook Program
last update: 3/17/09
2006
2007
2008
2009
2010
2011
2012
2013
2014
1 2 3 4
HATCHERY AND GENETIC MANAGEMENT PLAN
GPUD and PRCC HSC develop HGMP/M&E Plan
*
PRCC HSC HGMP review/approval
*
NMFS HGMP review/approval (assumes HGMP serves as Section 10 Permit App)
denotes NMFS approval of HGMP
USFWS HGMP consultation
FERC HGMP review/approval
denotes FERC approval of HGMP
ENVIRONMENTAL ASSESSMENT
Wetland delineation
Biological survey/assessment/analysis
Cultural survey/assessment/analysis
Stakeholder Outreach
COMPLIANCE - NEPA/ESA
NMFS
NMFS reviews HGMP for completeness (if complete, posted to FR)*
NMFS prepares/reviews EA to consider impacts
Address comments to EA and permit application
FONSI issued
Receive final take permit (Section 10) with take authorizations and conditions
USFWS
Collect data for BA to determine impacts to bull trout
Submit Incidental Take Statement request w/final BA: Post to Fed. Reg.
Receive final bull trout ITS with take authorization and conditions
PRELIMINARY DESIGN
McComas Acclimation Facility
Groundwater evaluation
Conceptual intake/pond/site designs
Pre-engineering meeting with permitting agencies
HSC review of conceptual designs

White River Spring Chinook Program



White River Spring Chinook Program	2006	2007	2008	2009	2010	2011	2012	2013	2014
comments									
Incorporate permit comments/conditions									
Complete design drawings and QA/QC									
Complete technical specifications									
PRCC HSC review final designs									
Capital - O&M cost estimates									
Construction bid process/contract award									
Construction									
Construction complete									
OPERATIONS									
Captive Brood*									
Egg/Fry Collection									
Incubation and Rearing									
Spawning									
Adult-Based Supplementation									
Adult Collection									
Adult Holding									
Spawning									
Juvenile Rearing for Smolt Release - Captive Brood and/or Adult-Based									
Incubation									
Rearing (LWSNFH)									
Acclimation									
Net Pens (under Permit 1592)									
Submit land-use approvals									
Deployment									
Water Quality Monitoring									
Acclimation									
River Mile 11 & McComas Seine Acclimation (under Permit 1592)									
Determine if channel is important fish hab.									
Survey channel - head drop/pond space									
Draw site plan									



Transition from captive brood to adult-based program has not been discussed and will dictate when and where these activities will occur. Activities would occur in existing facilities prior to McComas facility construction completion.

Denotes Grant PUD activities

Denotes non-Grant PUD activities

* Activities occurred prior to 2006

This schedule assumes development (and associated timeline) of an EA, rather than EIS.

1.15) Watersheds targeted

White River (Wenatchee River system, Washington) –WRIA #45.

1.16) Alternative actions considered.

Alternative actions were considered during development of the BAMP. The co-managers, NMFS, WDFW, USFWS, CCT, CTUIR, YN, and Chelan, Douglas, and Grant PUDs (the Yakama Nation has been peripherally engaged in the current White River Captive Program) concluded in the BAMP that many populations are at high risk for extinction, and artificial propagation is essential for recovery.

The discussion of alternative actions is summarized in the BAMP as follows:
"The co-managers concluded that many populations are at high risk of extinction, and artificial propagation was essential for their recovery. However, there was substantive debate on how to categorize and propagate the populations. Critical uncertainties were: (1) the level of population structure of mid-Columbia spring Chinook salmon, (2) which strategies posed the least risk to the populations while having the highest likelihood of recovering them, and (3) whether these recovery measures were logistically feasible. The co-managers investigated several alternatives that could be used in the recovery process, while promoting within- and among-population genetic variability for the nominal populations. Some alternatives either presented an increased risk to the sustainability of the populations, or have low feasibility in implementation. As a result, the most appropriate plan included a limited use of many strategies to spread the overall risk to the populations and to test the effectiveness of each strategy. "Spreading the risk" includes the use of more than one artificial propagation strategy, collecting broodstock at more than one life stage, predetermined means to manage stray fish, variable levels of population separation, and designation of "reference" populations that will not be artificially propagated. All strategies will be monitored to allow comparison of the effectiveness of each alternative and subsequently, adaptive management of the program."

Several basic alternatives for using artificial propagation for recovery of spring Chinook were evaluated in the BAMP. These included various levels of supplementation, captive rearing of a portion of the natural population, and infusion of non-native gametes into the gene pool. The preferred strategy for the White River was developed after considering these alternatives and the BAMP recommendations that reference populations be maintained and that large scale risk be reduced to the ESA by implementing multiple recovery methods.

For the White River MaSa, alternatives that did not involve artificial propagation were determined not to be adequate to avoid the immediate risk of extinction. One of several significant mortality factors facing this stock is mortality experienced while passing through mainstem hydropower facilities during downstream smolt migration. Passage improvements to hydropower facilities have been underway for decades. However, even when passage protection is maximized there may be a level of mortality that requires continued artificial propagation.

Other program options considered:

- Make collections for all the Wenatchee spawning aggregates above Leavenworth (which includes all the Wenatchee population major spawning areas) at Tumwater Dam. Managing the upper Wenatchee as a single unit would help insure that abundance targets for each spawning area could be met which would reduce short-term extinction risks. However, it would eliminate any population structure that may currently exist and preclude it's development (ICBTRT 2007b).

- End the supplementation program after 3 generations whether or not performance standards for ending the program (see standard 2.5 in section 1.6) are met. The ICBTRT (2007b) concludes that hatchery supplementation programs that continue for more than 3 generations do not, in most cases, meet viability criteria. However, ending the program prior to abundance criteria being met may leave the White River MaSa with a high extinction risk (ICBTRT 2007b).

SECTION 2. PROGRAM EFFECTS ON NMFS LISTED POPULATIONS

USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A.

2.1) ESA permits and authorizations.

ESA April 2007 – Section 10 permit #1592 (NOAA Fisheries 2007) was issued for a term of 3 years in April 2007 to Grant PUD, WDFW, and the YN as joint permit holders to carry out the minimal activities associated with the White River UCR spring-run Chinook salmon supplementation program. The following activities are authorized by Permit 1592:

- Collection of eggs or fry from the White River to rear in captivity to adult to use as broodstock;
- Transfer of eggs or fish between Federal, state, and private hatchery facilities as necessary to successfully rear fish to the yearling smolt stage;
- Rearing and propagation from the fertilized egg through the yearling smolt life stage at Federal, state, and private hatchery facilities;
- Acclimation of pre-smolts in the White River basin;
- Release of juvenile spring Chinook salmon into the White River in Chelan County, Washington;
- Monitoring of the programs in the hatchery environment using standard techniques such as growth and health sampling; and
- Monitoring of the programs in the natural environment using standard techniques such as juvenile fish traps and adult spawner surveys.

Permit 1592 does not authorize the construction of any permanent hatchery or fish collection facilities in the White River basin or elsewhere outside the White River basin.

Section 10(a)(1)(B) Permit Number 1482 (1203) authorizes the annual take of listed salmonids while conducting research designed to collect biological data on the salmonid populations in question, determine where salmonids are present, genetically identify individual salmonid stocks, and examine habitat conditions where the salmon and steelhead are found. Issued to WDFW. Expired December 31, 2008.

This HGMP, when completed, is expected to be submitted to NMFS as part of a new ESA consultation and permitting process.

2.2) Descriptions and projected take actions for ESA listed populations.

2.2.1) Description of affected NMFS ESA-listed salmonid population(s).

<u>Upper Columbia River Spring-run Chinook Salmon</u>

Adult spring Chinook salmon (*Oncorhynchus tshawytscha*) enter the Columbia River from March through mid-May (Myers et al. 1998). Peak abundance of the run in the lower Columbia River occurs in April and May (Chapman et al. 1995). Upper Columbia-origin spring Chinook exhibit peak migration at Rock Island Dam in mid-May. The fish spawn in the Wenatchee, Entiat, and Methow rivers from August through September, peaking about mid-August. The majority of adult spring Chinook salmon mature at four and five years of age. Adults average 66 cm for females and 67 cm for males (Chapman et al. 1995). Fecundity for female Chinook may range between 2,600 and 8,100, based on data for the Chiwawa and Methow River populations.

Juvenile wild UCR ESU spring Chinook salmon are present at various life stages year-round in the Wenatchee, Entiat, and Methow rivers and tributaries. Eggs incubate from August through late fall or early winter, when the eggs generally hatch (Chapman et al. 1995). Alevins remain in the gravel 4-6 weeks or more, emerging as fry in late winter or early spring. Spring Chinook salmon fry disperse extensively downstream after emergence, although some fry assume residence in the natal stream near the spawning site. A second downstream movement occurs during late fall when Chinook emigrate to suitable over-wintering habitat, usually from the tributaries to the river mainstem. A third and final downstream movement takes place in the spring when the Chinook migrate as yearling smolts to the sea. The average 10%, 50%, and 90% passage of the seaward smolt migration measured at Rock Island Dam from 1985-1994 was April 21, May 10, and June 3, respectively (Chapman et al. 1995). Wild fry and sub-yearling spring Chinook salmon may range in size from 30-40 mm in the spring, average 54 mm in June, and average 88 mm by October. Upper Columbia River spring Chinook migrating seaward as yearling fish may average 87 to 127 mm.

The proposed program will focus on the White River MaSa within the Wenatchee River basin. Marshall and Young (1994) and Utter et al. (1995) identified the White River spawning aggregate as having sufficient genetic differentiation to be considered distinct from other sampled spring-run Chinook populations. Most recently, Murdoch et al. (2006) conducted population genetic analysis, pedigree reconstruction and fitness estimation of hatchery and natural origin spring Chinook spawning aggregates in the upper Wenatchee River basin for brood years 2004 and 2005 and concluded that population genetic structure appears to exist within Wenatchee basin spring-run Chinook and that significant allele frequency differences exist between the three major spawning aggregates (Chiwawa River, Nason Creek and White River). Furthermore, Murdoch et al. (2006) concluded that hatchery-origin Chinook from Leavenworth National Fish Hatchery (LNFH) and White River natural-origin spring Chinook represented the greatest separation from all other natural-origin spring Chinook populations in the Wenatchee basin. It is anticipated that the population genetic analysis, pedigree reconstruction, and fitness estimation efforts will continue for the next 8-10 years and compilation of multiple years of data will provide greater insight to the population structure of spring-run Chinook in the Wenatchee River basin.

The apparent genetic separation of the White River MaSa from other hatchery and natural-origin spring-run populations in the Wenatchee basin may reflect selective survival attributes specific to the White River ecosystem which is characterized by lacustrine environment (Lake Wenatchee), high fine-sediment substrates and glacial fed headwaters. Juveniles must pass through Lake Wenatchee on their way to the Columbia

River, and returning adults pass through a second time to reach the spawning grounds. Spawning takes place between river mile 8 and river mile 13 from the second week in August through the fourth week in September (Murdoch and Hopley 2005). Little is known about the specific juvenile life history of the White River MaSa. Juvenile monitoring was initiated in 2007 to characterize juvenile migration patterns, life history strategies, and productivity.

<u>Upper Columbia River Summer Steelhead</u>
Steelhead (*Oncorhynchus mykiss*) display the most complex life history traits of any Pacific salmonid (Busby et al. 1996). They can be anadromous or resident with the anadromous form spending up to seven years in freshwater prior to smoltification and seaward migration. They can spend up to three years in saltwater before returning to spawn (Busby et at. 1996). Two major run types are identified: ocean-maturing and stream-maturing. The ocean-maturing run type (winter steelhead) usually enters freshwater coastal and lowland streams in November through April and spawns soon thereafter. The stream-maturing run type (summer steelhead) generally enter freshwater from May through October and are sexually immature, requiring several months to spawn (Busby et al. 1996). The stream-type runs typically spawn in inland steams.

The UCR Steelhead ESU occupies the Columbia River upstream of the Yakima River (excluded) to Chief Joseph Dam (62FR43937). NMFS has identified four independent populations within the ESU: the Wenatchee, Entiat, Methow, and Okanogan populations (Interior Technical Recovery Team 2003). Steelhead of the UCR ESU is classified as stream-maturing type, similar to other inland steelhead ESUs (Snake and mid-Columbia rivers). Detailed descriptions of the UCR ESU are provided in Busby et al. (1996), WCSBRT (2003), and ITRT (2003).

Adult steelhead from the UCR ESU return to the Columbia River from May through September and migrate into the tributaries, usually beginning in mid-July and peaking in mid-September through October (Busby et al. 1996, WCSBRT 2003, Fisheries 2002). The predominant adult age class is 2-salt (51%) followed by 1-salt (47%). Two percent return as 3-salt (WDFW 2002). Some may stay in mainstem reservoirs and migrate into tributaries in April or May of the following year (WCSBRT 2003). Typically they spawn in late spring of the calendar year after entering freshwater. In the Wenatchee River, summer steelhead arrive in mid-July and through April the following year. Spawning is from April through June (WDFW 2002, WDFW 1993). Eggs incubate late March through June and fry emerge late spring through August (WDFW 2002). Life stages are present year-round in the tributaries of the UCR ESU. Fry and smolts disperse downstream in late summer and fall. Outmigration occurs during April and May and is dominated by 3+ (46.6%) and 2+ (43.2%) age-class smolts (Peven 1990). Since 2002, the estimated number of steelhead redds found in the White River basin has been one (range 0-3). The sporadic spawning suggests that no established spawning populations exist in the tributary (personal communication, M. Tonseth, WDFW).

- Identify the NMFS ESA-listed population(s) that will be directly affected by the

program.
Upper Columbia River Spring Chinook

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.
Upper Columbia River Summer Steelhead

2.2.2) Status of affected NMFS ESA-listed salmonid population(s).

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (see definitions in "Attachment 1").
Upper Columbia River Spring-run Chinook Salmon
The following status summary is from the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009):

"On March 24, 1999, NMFS listed UCR spring Chinook salmon as an endangered species under the ESA (64 FR 14308). In that listing determination, NMFS concluded that the UCR spring Chinook salmon were in danger of extinction throughout all or a significant portion of their range. NMFS also determined that six hatchery stocks in the UCR basin which propagate local stocks of spring Chinook salmon should be included as part of the species because they were considered essential for recovering the fish. When NMFS re-examined the status of the UCR Chinook in 2005 (70 FR 37160), they came to the same conclusion that the species warranted listing as endangered. The UCR Spring Chinook Salmon Evolutionarily Significant Unit (ESU) is made up of three extant populations; Methow, Entiat, and Wenatchee.

As summarized in the Recovery Plan, when considering the factors that determine diversity and spatial structure, the Wenatchee spring Chinook salmon population is currently considered to be at a high risk of extinction because of the loss of naturally produced Chinook salmon spawning in tributaries downstream from Tumwater Canyon. In addition, the Wenatchee spring Chinook salmon population is currently not viable with respect to abundance and productivity and has a greater than 25% chance of extinction in 100 years. In sum, the Wenatchee spring Chinook salmon population is not currently viable and has a high risk of extinction. The Wenatchee population includes five major and four minor spawning areas. The number of spring Chinook salmon redds built in each major spawning area has varied widely in the last 20 years (Hillman et al 2008).

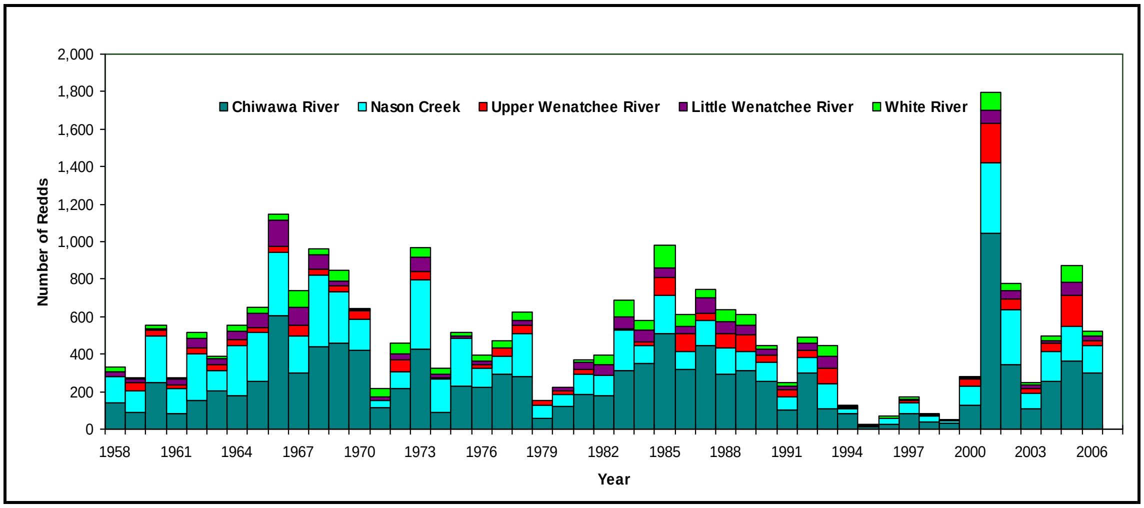


Figure 5. Number of redds in each major spawning area of the Wenatchee spring Chinook salmon population.

Abundance and Productivity

The following data summarizes the recent abundance and productivity assessment of the Wenatchee spring Chinook salmon population:

- The 1960-2003 Wenatchee Basin UCR adult spring Chinook abundance is estimated to have ranged from 6,718 (1966) to 51 (1995).
- The most recent 10-year (1999-2008) contribution of naturally produced adults averaged 30.4% (or about 70% hatchery fish) measured at Tumwater Dam, ranging from 10.5%-87.4%.
- The most recent 10-year (1999-2008) geometric mean of natural origin returns (for the entire population) was 650 adults and the most recent 12-year (1990-2002) geometric mean of Recruits/Spawner was 0.56 (unpublished WDFW Tumwater Dam data provided by Andrew Murdoch).

Overall run sizes are primarily composed of hatchery fish produced as mitigation for impacts from mainstem Columbia River hydroelectric projects. Natural origin run sizes have remained below 1,000 for most years since 1999, while hatchery run sizes are increasing.

Spatial Structure

Wenatchee spring Chinook consist of five major spawning areas; Chiwawa River, Nason Creek, White River, Little Wenatchee River and Upper Wenatchee mainstem. These areas are all accessible to and currently occupied by spring Chinook salmon. The minor spawning areas include; Chumstick Creek, Peshastin Creek, Icicle Creek, and Mission Creek in the lower watershed (below Tumwater Dam). These areas support few spring Chinook salmon.

Genetic Diversity and Spawner Composition

The Wenatchee Basin spring Chinook population has been partially homogenized with other UCR populations due to past hatchery practices. This was primarily due to the Grand Coulee Fish Maintenance Program of the 1940s. However, allozyme samples

(1980s) and recent microsatellite data (late 1990s and early 2000s) indicate that some substructure still might appear to exist within the Wenatchee population (ICTRT 2007d; Blankenship et al. 2007; Ken Warheit pers. comm. 2008).

Spawner composition within the Wenatchee River Basin includes local and non-local stocks. Non-endemic (out-of-ESU) spawners are predominately from strays associated with the Leavenworth NFH program. Although the Leavenworth NFH program stray rates are low (<1% of the total fish returning), they are estimated to have comprised between 3%-27% of some spawning aggregates above Tumwater Dam (WDFW unpublished data). Spawners from outside the Wenatchee population, but within the Upper Columbia ESU, occur in small numbers and generally comprise less than 2% of any spawning aggregates above Tumwater Dam (WDFW unpublished data). Within-population hatchery spawners (Chiwawa stock) have comprised 56% of the spawning population above Tumwater Dam since 1993 and have routinely comprise greater than 10% of the spawning population in Nason Creek, White River, Little Wenatchee, and Upper Wenatchee mainstem in past years (Tonseth 2003; 2004). Modifications to the Chiwawa Rearing Ponds water intake in 2005 may reduce the incidence of straying by Chiwawa-origin hatchery adults; first results will be monitored in 2009.

Viability / Extinction Risk Analysis

The ICTRT developed criteria for assessment of anadromous salmonid population viability (ICTRT 2007b). In development of the Recovery Plan (UCSRB 2007), the ICTRT criteria were considered, and primarily followed. However, there were some differences, and since NMFS has accepted the Recovery Plan (72 FR 57303), those criteria should be considered when comparing the recommendations within this Implementation Plan. The population level viability guidelines are organized around four major parameters: abundance, productivity, spatial structure and diversity that define a Viable Salmonid Population (VSP).

For the Wenatchee spring Chinook population, the Recovery Plan (UCSRB 2006) calls for a 12-year geometric mean for abundance and productivity of 2,000 naturally produced spawners and at least 1.2 recruits per spawner, respectively. For spatial structure at least 5% of the total number of redds need to be within each of the five major spawning areas, or at least 20 redds per major spawning area, whichever is greater. For viability, the score of the eight metrics needs to result in a moderate category for risk in a spreadsheet developed by the ICTRT.

Based on VSP parameters and current status of the Wenatchee spring Chinook population, the population is believed to be at high risk of extinction over the next 100 years (i.e. >25% risk). The natural origin population cannot achieve any level of viability without substantial improvements in abundance and productivity (ICBTRT 2007a,b; UCSRB 2006). Because of historic practices, genetic homogenization within and among UCR spring Chinook populations was also rated as a high risk factor for spatial structure and diversity, further increasing the overall risk of extinction (ICBTRT 2007a,b)."

Upper Columbia River Summer Steelhead

The steelhead BRT (BRT, Busby et al. 1996) assessed the status of west coast steelhead (*O. mykiss*) from Washington, Idaho, Oregon, and California. The BRT identified 15 ESUs including the UCR summer steelhead ESU which includes all Columbia River tributaries above the Yakima River. All UCR steelhead are summer steelhead. Busby et al. 1996, citing Chapman 1994, reported pre-1960s fish counts at Rock Island Dam (1933 – 1959) averaged 2,600 – 3,700. The 1989 – 1993 natural escapement estimates were 800 for the Wenatchee River and 450 for the Methow and Okanogan rivers combined. Average total escapements for these stocks were 2,500 and 2,400, respectively. Trends in total (natural and hatchery combined) escapement between 1962 and 1993 showed a 2.6% increase. A 12% decline was reported for the Methow and Okanogan rivers combined. Nehlsen et al (1991) identified six stock in this region that were either at risk or stocks of concern. WDFW (1993) identified three stocks and characterized all as depressed.

Spawning escapement within the ESU is strongly dominated by hatchery production with estimates of recent contributions averaging 65% in the Wenatchee River and 81% in the Methow and Okanogan rivers (Busby 1996). Adult replacement ratios were 0.3:1.0 in the Wenatchee and 0.25:1.0 in the Entiat (WDFW 1993) and were believed not to be self-sustaining without continued hatchery supplementation.

Busby et al. (1996) concluded that the UCR steelhead ESU was in danger of extinction. Even though total abundance of populations within the ESU was relatively stable or increasing, it was thought to be occurring only because of major hatchery supplementation programs. The major concern of the BRT was the clear failure of natural stocks to meet self-replacement goals. In addition, the BRT was strongly concerned about problems of genetic homogenization due to hatchery supplementation within the ESU. There was also concern for high harvest rates on steelhead in rainbow trout fisheries and degradation of freshwater habitats within the region.

In August 1997, NMFS listed the UCR Steelhead ESU as endangered (62 FR 43937). Subsequently, using the VSP guidelines described by McElhany (2000) an initial set of population definitions for the UCR steelhead ESU identified the Wenatchee River, the Entiat River, and the Methow River as separate populations within the ESU (Ford 2000).

More recently, the WCSBRT (2003) completed an updated status review of west coast steelhead, including the UCR steelhead ESU. The BRT found that returns of both hatchery and naturally produced steelhead in the upper Columbia River have increased in recent years. The average combined return through Priest Rapids Dam was 12,900 steelhead between 1997 and 2001. The average for the previous five years (1992-1996) was 7,800. The total returns, however, continue to be dominated by hatchery-origin fish. Although the percentage of natural-origin returns had increased to about 25% during the 1980s, the median percent of natural-origin fish between 1997-2001 was 17% (2,200 of 12,800), a slight improvement of the period between 1992 and 1996 when the percentage of natural-origin fish in the run was less than 10% (1,040 of 7,800). The five-year geometric mean natural-origin escapement for the Wenatchee and Entiat rivers for 1997-2001 was 900, well below the interim recovery goal of 3,000 (Lohn 2002). While there is an increasing growth trend of approximately 3.4% per year, the natural-origin proportion in the Wenatchee/Entiat has declined from 35% to 29%.

The WCSBRT (2003) concluded that the UCR steelhead ESU continues to be in danger of extinction based on evaluation of natural production. The most serious risk to the natural population is the low growth rate and productivity within the ESU. Although there has been an increase in naturally-produced fish in recent years, mean abundance is still only a fraction of the interim recovery goal. The ratio of naturally produced adults to combined parents escapement is still low (about 43%, Murdoch et al. 1998) and detailed information on productivity is lacking.

Table 7 Progeny-to-parent ratios for the White River spring Chinook salmon population..

White River spring Chinook recruits per spawner 1981 – 2000. Data provided by Andrew Murdoch – WDFW. Not adjusted for harvest impacts.			
Year	Spawners	Recruits	Recruits/ Spawner
1981	60	330	5.5
1982	180	165	0.9
1983	308	114	0.4
1984	181	131	0.7
1985	404	112	0.3
1986	204	49	0.2
1987	99	58	0.6
1988	139	98	0.7
1989	141	59	0.4
1990	49	6	0.1
1991	49	12	0.2
1992	78	25	0.3
1993	132	33	0.2
1994	7	8	1.2
1995	5	8	1.6
1996	30	46	1.5
1997	33	149	4.5
1998	11	57	5.2
1999	3	1	0.3
2000	20	52	2.6
2001	215	81	0.38

Table 8. Redd counts and estimated run abundance in the White River.

White River spring Chinook annual redd counts and estimated run size, 1995 – 2007 (compiled from WDFW, unpublished data and NMFS 1999)			
Year	Redd Count	Expansion Factor	Estimated Run Size
1995	2	2.2	4
1996	12	2.2	26
1997	15	2.2	33
1998	5	2.2	11
1999	1	2.2	2
2000	8	2.70e_/	21
2001	99a_/	1.60d_/	158c_/
2002	33a_/	2.05d_/	68c_/
2003	14a_/	2.43d_/	33c_/
2004	20a_/	3.00b_/	61c_/
2005	27a_/	1.80b_/	49c_/
2006	31a_/	1.78b_/	55c_/
2007	12a_/	4.48b_/	54c_/
a_/ White River stock redds estimated when adjusted for stray rates b_/ expansion based on sex ratio from Tumwater Dam c_/ White River stock adults when adjusted for stray rates d_/ expansion based on sex ratio from broodstock collected for Chiwawa e_/ expansion based on sex ratios from Tumwater video			

Table 9. Origin of spawners in the White River.

Brood Year	Origin of spawners (compiled from WDFW unpublished data)	
	Wild	Hatchery – Most if not all are strays from Chiwawa H.
1994	100.0	0.00
1995	0.8	0.20
1996	100.0	0.00
1997	100.0	0.00
1998	100.0	0.00
1999	100.0	0.00
2000	100.0	0.00
2001	0.67	0.33
2002	0.72	0.28
2003	0.75	0.25

2004	0.82	0.18
2005	0.31	0.69
2006	0.86	0.14
2007	0.59	0.41
2008	0.30	0.70

Sections 1.9, Current Program Performance, and 9.2.1, Survival Rates, present data on the performance of brood held in captivity. As of June, 2009, no returning adults from the captive brood program have been detected in the White River and data for smolt survival has not been calculated.

2.2.3) Hatchery activities.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Broodstock Collection:

Juvenile-based Captive Brood.

Collection of eggs/fry for captive broodstock will result in a direct take of listed spring Chinook from natural production. Sampling might result in disturbance of redds and increased mortality of remaining eggs/fry. Fewer individuals will remain in the natural habitat for natural rearing. Although strict precautions are taken, sampling might also result in the disturbance of Bull trout redds in the immediate area of spring Chinook redds being sampled. There will be no impacts to steelhead.

Adult-based Supplementation.

Collection of adults for hatchery propagation will result in removal of a portion of the natural spawning population. Implementation of adult collection strategies may result in delay of migration for some spawners or displacement of spawners below the collection site. Specific M&E actions (i.e. snorkeling above and below the collection site to assess extent of possible delay and PIT-tag interrogation of fish passing though the collection site) will be conducted to assess potential impacts to migration. During adult collection/monitoring activities, a portion (those fish handled) that did not originate in the target tributaries (e.g., Chiwawa River) might be removed and transported to their natal tributaries or hatchery programs for spawning. Also, adults will be handled at Tumwater during the potential reproductive study or for stock identification. Natural origin adults may also be trapped and handled/PIT tagged at Priest Rapids Dam as a component of the Parental-based broodstock trapping collection protocol currently under development and discussion/review by signatories to the HCP and Priest Rapids Settlement Agreement. Should the parental-based tagging be determined as a viable option for broodstock collection, a pilot program will be conducted prior to full-scale implementation to assess potential negative impacts to migration behavior and post trapping survival associated with the parental-based tagging. Impacts to listed species during adult collection/monitoring of spring Chinook will be minimized through development and implementation of NMFS, USFWS and PRCC HSC approved adult spring Chinook collection/monitoring methods/schedules, fish handling protocols, and take provisions provided by NMFS and USFWS.

Juvenile Rearing:

Juvenile-based Captive Brood.

All spring Chinook life stages will be propagated (and therefore taken) through the proposed captive rearing program. Eyed eggs and alevins will be hydraulically sampled from redds in the rivers during the winter or late summer to be reared as broodstock at the Little White Salmon NFH. Juveniles used for the captive brood phase will be retained in the hatchery and reared for an additional two to three years to maturity. Fish reaching maturity will be spawned with subsequent rearing of offspring to occur at the Little White Salmon NFH. Fry, fingerlings and smolts produced will be similar in size to supplementation program fish with fingerling size of 1.1 – 7.0g achieved through the summer, ~15g by fall, and ~32g at yearling age. Pre-smolts will be transported to sites on the White River for acclimation prior to release.

Adult-based Supplementation.

Green eggs, eyed eggs and alevins will be incubated to produce swim-up fry averaging approximately 0.45 grams each. Fry will be reared to fingerling size (1.1 – 7.0g) through the summer months, with sub-yearlings (~15g) produced by the fall. Yearling smolts at an average size of ~32g will be produced by late spring. Pre-smolts will be transported to sites on the White River for acclimation prior to release.

Adult Management:

Both natural and hatchery origin spring Chinook may be handled at Tumwater Dam for purposes of managing escapement to the White River consistent with JFP identified escapement and PNI objectives. Hatchery origin Chinook may be removed from the spawning escapement throughout the spring Chinook run timing at Tumwater Dam as necessary to achieve the identified escapement and PNI objectives. Takes associated with this activity may include delayed migration, delayed mortality, and unintentional immediate mortality associated with handling. Although these takes may occur, past trapping/tagging/sampling efforts at Tumwater Dam through the on-going spring Chinook reproductive success study have not identified any immediate unintentional mortality associated with the trapping effort. Delayed mortality is difficult to assess; however the calculated pre-spawn mortality (PSM) during years of the reproductive success study are generally within the pre-spawn mortality ranges calculated for years prior to the initiation of the reproductive success study. Pre-spawn mortality may be affected more by abundance than by handling at Tumwater Dam as pre-spawn mortality is positively correlated with female abundance. Potentially, PSM may be reduced through adult management actions that reduce over-escapement.

Monitoring and evaluation activities:

Both juveniles released by the program and naturally produced fish in the White River are monitored. Also, hatchery and natural origin adult returns are part of the M&E

program.

Take may result from adult and juvenile capture, handling, tagging, release and unintentional injury. Juvenile emigration monitoring may include up to a 0.20 encounter rate (capture) and up to 0.02 mortality rate for those encountered. Takes associated with juvenile monitoring activities will include tagging/marking, biological sampling and genetic tissue sampling. Adult spring Chinook takes associated with M&E activities may include capture/handle/release (including enumeration, origin determination, biological data collection and genetic sampling) and possibly translocation of non-White River hatchery-origin spring Chinook. No injury or mortalities are expected during the White River adult carcass and spawning ground surveys. Biological data and samples will be taken from only deceased, spawned out fish.

The Section 10 permit application (Grant Co. PUD et al. 2006) describes the estimated take that results from current M&E activities associated with the juvenile-based captive brood phase. The M&E program and resulting take is expected to be similar during the future captive adult-based phase.

Incidental and possible lethal take of steelhead may occur during juvenile M&E activities. However, this may supply valuable information on steelhead to fish resource managers.

Table 10. Summmary of hydraulic sampling of White River spring Chinook salmon redds.

Summary of hydraulic sampling of White River spring Chinook redds (A. Murdoch, WDFW, personal communication).			
Brood Year	Number of eggs extracted from the White River		
	Live eyed eggs/fry	Sampling mortality	Unfertilized dead eggs
1997	527	0	0
1998	199	0	0
1999	0	0	0
2000	272	0	~100
2001	0	0	0
2002	183	1	16
2003	723	25	30
2004	1,529	33	36
2005	2,763	74	64
2006	1,488 (fry)	1	0
2007	1,166	13	0
Total	*8,850 (95.8%)*	*147 (1.6%)*	*246 (2.6%)*

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program

See above and Table 1 in section 14.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Take levels for captive brood are not expected to exceed the levels described herein. Take levels will be reviewed in-season but prior to initiation of redd pumping reducing the probability they will be exceeded.

As the program converts into adult-based supplementation, take levels at the adult trapping facilities will be projected prior to the trapping season. Adjustments to collection rates will be made in season if the planned trapping schedule will result in excess collection of adults.

2.3) Long-term impacts to ESA listed populations.

Wenatchee Population Recovery

This program is consistent with the goals of Upper Columbia River Spring Chinook Salmon and Steelhead Recovery Plan (UCRSB 2006). That plan was summarized in the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009):

"The Recovery Plan provides the following recovery objective:
"Increase the abundance of naturally produced spring Chinook and steelhead spawners within each population in the Upper Columbia ESU and Distinct Population Segment to levels considered viable. Increase the productivity (spawner:spawner ratios and smolts/redds) of naturally produced spring Chinook and steelhead within each population to levels that result in low risk of extinction. Restore the distribution of naturally produced spring Chinook and steelhead to previously occupied areas where practical and allow natural patterns of genetic and phenotypic diversity to be expressed."

The Recovery Plan provided criteria of naturally produced spring Chinook salmon to address quantitative and qualitative measurements of abundance, productivity, spatial structure, and diversity on a population basis.

Abundance and Productivity

Recovery Plan criteria require that the 12-year geometric mean for abundance and productivity of naturally produced spring Chinook within the Wenatchee, Entiat, and Methow populations must reach levels that would have less than a 5% risk of extinction over a 100-year period. At a minimum, the Upper Columbia Spring Chinook ESU will have productivity greater than 1.0 and maintain at least 4,500 naturally produced spawners distributed among the three populations.

Spatial Structure/Diversity

Specific to the Wenatchee population, the Recovery Plan states that naturally produced spring Chinook salmon spawning must be present over a 12-year period within four of the five major spawning areas in the Wenatchee subbasin (Chiwawa River, White River, Nason Creek, Little Wenatchee River, or Wenatchee River) and within one minor spawning area downstream from Tumwater Canyon (Chumstick Creek, Peshastin Creek, Icicle Creek, or Mission Creek). The minimum number of naturally produced spring Chinook redds within each major spawning area will be either 5 percent of the total number of redds within the Wenatchee subbasin or at least 20 redds within each major area, whichever is greater. The Recovery Plan does not provide a numeric goal for any of the minor spawning areas but simply states that natural origin spring Chinook salmon spawning should occur in one minor spawning area downstream from Tumwater Dam. The Recovery Plan redd distribution meets the defined criteria but does not reflect the observed redd distribution in the basin. Applying the average observed redd distribution among the five major spawning areas from 1958 to 2003 provides a distribution of spring Chinook salmon ranging from a low of 57 redds in the upper Wenatchee River, historically the smallest major spawning area, to 409 redds in the Chiwawa River which is the largest major spawning area.

In addition, specific to the Wenatchee population, the Recovery Plan states that the mean score for the three metrics of natural rates and levels of spatially mediated processes will result in a moderate or lower risk assessment for naturally produced spring Chinook and all threats for “high” risk have been addressed. The Recovery Plan further states that the score for the eight metrics of natural levels of variation will result in a moderate or lower risk assessment for naturally produced spring Chinook within the Wenatchee population and all threats for “high” risk have been addressed.”

Risks

Supplementation may impose genetic and ecological risks to the natural-origin White River spring Chinook MaSa. The long-term impacts of supplementation on natural salmonid stocks are being studied in several locations. For example, a recent study of Oregon steelhead (Araki et al. 2007) has shown a reduction in the reproductive fitness of native populations due to hatchery fish after several generations of interaction

The Independent Scientific Advisory Board (ISAB), which was formed to help make funding recommendations to the Bonneville Power Administration, produced an assessment of the risks and benefits of supplementation (ISAB 2003). Most of the recommendations of the ISAB report have been adopted by this program. Also, the ISAB review of existing literature stated “The conclusions that can be drawn from the collective body of existing empirical information relevant to supplementation is that there is credible potential for a benefit to very small wild populations and credible potential for harm at any population size.”

The ISAB recommends a cautious, limited approach to the use of supplementation. Other regional fishery experts have different viewpoints. Discussions of the benefits of using hatcheries to supplement natural populations are presented in several papers (Brannon et al. 2004, Cuenco et al. 2003).

A commonly accepted definition of supplementation (RASP 1992) is: "…. the use of artificial propagation in an attempt to maintain or increase natural production, while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on non-target populations within specified biological limits." Supplementation programs have demonstrated their ability to make at least short term increases to natural production.

The Yakima/Klickitat Fisheries Project (YKFP) is a large-scale, sophisticated hatchery supplementation program targeting the Yakima River spring Chinook population that began releasing fish in 1999. It is designed to test whether artificial propagation can be used to increase natural production and harvest opportunities while limiting ecological and genetic impacts. Permanent counting and collection facilities at Roza Dam and the Chandler Bypass Juvenile Facility, production facilities at the Cle Elum Supplementation and Research Facility (CERSF) and three acclimation sites, and an experimental spawning channel (at CESRF) are project components that are operated to support supplementation monitoring and evaluation objectives.

Annual reports and peer reviewed papers are being produced that describe YKFP test procedures and results. Estimates are that complete evaluations will take from 8-30 years; however, early data is available and is being evaluated. A 2005 summary is presented in: Spring Chinook Salmon Supplementation in the Upper Yakima basin; Yakima/Klickitat Fisheries Project Overview (Pearsons et al. 2005). As described in more detail in the Overview, the program is designed to answer four basic questions. Those questions and YKFP preliminary findings are:

1) Can integrated hatchery programs be used to increase long-term natural production? The program has increased the number and distribution of adult spawners in the Yakima River. However, reproductive success and domestication experiments are showing some differences between hatchery-origin and natural-origin that may impact natural production over long periods. Most measured variables are similar, however hatchery origin fish were smaller-at-age than natural origin fish and slight changes in predation vulnerability and competitive dominance were documented.
2) Can integrated hatchery programs limit genetic impacts to non-target Chinook populations? Genetic impacts to non-target populations appear to be low because of the low stray rates of YKFP fish.
3) Can integrated hatchery programs limit ecological impacts to non-target populations? Ecological impacts to valued non-target taxa have been within program containment objectives.
4) Does supplementation increase harvest opportunities? Tribal subsistence and Yakima River sport fisheries have increased since the start of the program.

A NMFS analysis (see section 1.5) of the UCR spring Chinook population concluded that the benefits of using supplementation to recover the White River MaSa offsets the risks of long-term genetic impacts. Without supplementation, loss of fitness in this small spawning aggregation will likely occur due to both inbreeding by White River origin adults and outbreeding with other stocks. Supplementation, as demonstrated by YKFP results, can reduce the short-term threat of extinction of the White River MaSa.

2.4) Critical habitat

Identify the Action Area, Critical Habitat that lies within the Action Area, and any impacts to Critical Habitat from the proposed action.

The action area for the Wenatchee component of the Upper Columbia River Spring-run Chinook Salmon - White River Supplementation Program is the Wenatchee River basin. NOAA designated (Federal Register / Vol. 70, No. 170 / Friday, September 2, 2005 / Rules and Regulations) the Wenatchee basin as critical habitat for the upper Columbia River Spring-run Chinook Salmon ESA and the Upper Columbia River Steelhead ESU.

Impacts to the critical habitat due to proposed program actions are being evaluated through the NEPA and facility permitting processes. Potential impacts may result from water withdrawals for acclimation site operation, pond discharges entering receiving waters, and construction of facilities.

SECTION 3. RELATIONSHIP TO OTHER MANAGEMENT OBJECTIVES

3.1) Alignment of the hatchery program with ESU-wide hatchery plans.

The Upper Columbia Salmon Recovery Board coordinates recovery planning in the Upper Columbia basin, with funding from the Governor's Salmon Recovery Office, Upper Columbia Region. The Board assisted in the development of the Upper Columbia River Salmon, Steelhead, and Bull Trout Recovery Plan (UCRSRB 2007) which was adopted by NMFS on 10/9/2009. The NMFS webpage describing the plan is at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/Index.cfm.

Recovery objectives and criteria for the proposed plan were identified by the Interior Columbia basin Technical Recovery Team (ICBTRT) in collaboration with Upper Columbia technical committees. Local stakeholder assistance with recovery planning in the upper Columbia involves Douglas, Chelan, and Okanogan counties, state and tribal-sponsored recovery efforts, sub-basin planning, and watershed planning. The White River supplementation program is consistent with the objectives of the proposed recovery plan (UCRSB 2006). A listed objective is: “Continue to use artificial production to maintain critically depressed populations in a manner that is consistent with recovery and avoids extinction.”

The BAMP is a consensus plan by fish co-managers for development, operation, and evaluation of anadromous salmonid hatcheries in the Columbia River upstream of the Yakima River confluence. It is designed to bolster the productivity of salmonid populations in a manner that is compatible with self-sustaining populations. Guidance for the White River program, in addition to all artificial propagation programs for spring Chinook in the upper Columbia River, is provided in the BAMP.

The Chelan and Douglas PUDs worked cooperatively with state and federal fisheries agencies and tribes to develop the first Hydro Power Habitat Conservation Plans (HCPs) for anadromous salmon and steelhead. The plans commit the two utilities to a 50-year program to ensure that their hydro projects have no net impact on mid-Columbia salmon and steelhead runs. These HCPs were completed in 2002 and agreements are now in place which support recovery of several subpopulations of the upper Columbia River spring run Chinook ESU. The HGMP presented herein for the White River spring Chinook spawning aggregation will be consistent with the current HCPs. An additional HGMP will be written to address the Nason Creek spring Chinook subpopulation, thereby completing the integration of all augmented spring Chinook subpopulations within the UCR spring-run Chinook ESU. It is expected that all current recovery efforts will be consistent with the anticipated recovery plan.

The Hatchery Scientific Review Group (HSRG), as part of the Hatchery Reform Project, has completed a review of Puget Sound hatcheries (HSRG 2005) and has completed a similar review process for the Columbia River watershed (HSRG 2009). The project was conducted by an independent science team in conjunction with a Steering Committee comprised of representatives from regional agencies. The objective is to produce decisions that are based on broad policy agreements and are supported by consistent technical information about hatcheries, habitat, and harvest. The White River Supplementation Program review was included as part of this review. However, co-managers are developing a plan that has some differences from the HSRG recommendations for the White River.

Wy-Kan-Ush-Mi Wa-Kish-Wit (CRITFC 1995) was developed by the four Columbia River Treaty Tribes (Nez Perce, Umatilla, Warm Springs, and Yakama). It is a comprehensive plan put forward by the Tribes to restore anadromous fishes to rivers and streams that support the historical cultural and economic practices of the tribes.

3.2) Agreements under which program operates.

The program operates in accordance with the New License, Priest Rapids Hydroelectric Project No. 2114 (Grant PUD 2008) which was approved by the Federal Energy Regulatory Commission (FERC) on April 17, 2008. The license includes protection, mitigation and enhancement measures that address project effects on anadromous and resident fishes.

The overall direction for recovery of White River spring Chinook is contained in the Biological Opinion for ESA Section 7 Consultation on the New License for the Priest Rapids Hydroelectric Project (FERC No. 2114, NMFS Consultation No. 2006/01457). This HGMP is designed to be consistent with and implement the direction provided in the Biological Opinion.

The Priest Rapids Salmon and Steelhead Settlement Agreement (SSSA 2006) between Grant PUD, State and Federal Agencies and Indian Tribes describes a comprehensive and long-term adaptive management program for the protection, mitigation and enhancement of protected species, which may pass or be affected by the Priest Rapids Project. The SSSA lists 40 actions that are being undertaken for the protection of spring Chinook and steelhead. These actions involve: passage conditions, spill, total dissolved gases, habitat protection and improvement, avian and fish predator control, adult fishways, performance monitoring and reporting, and program funding and management. Terms and Conditions 1.26 and 1.27 provide direction specifically for the White River Spring-Run Chinook Program.

In 2009, representatives of the YN and WDFW developed a draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009). "It is designed to balance the management priorities of the Yakama Nation and WDFW with the regulatory guidelines for recovery of the ESA-listed Wenatchee spring chinook population. Accordingly, it considers new information developed by the Interior Columbia Technical Recovery Team (ICTRT), the Upper Columbia River Spring Chinook Salmon and Steelhead Recovery Plan, and other information sources." The

Implementation Plan (YN and WDFW 2009) has not been formally adopted by the JFPs (Joint Fisheries Parties) or by the PRCC HSC as of June, 2009. It is quoted in this document with the assumption that elements of the plan may change.

The program must also be consistent with NMFS policy for artificial propagation under the ESA, fulfillment of federal treaty obligations to Native Americans, fulfillment of court approved actions developed under the auspices of United States v. Oregon, the discharge of fisheries mitigation responsibilities incurred as a result of water development authorizations, and achievement of U.S./Canada Pacific Salmon Treaty obligations. The proposed program implements part of the BAMP (1998) as developed and agreed upon by the co-managers.

3.3) Relationship to harvest objectives.

The draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009) reviews the regional harvest management guidelines:
“This plan [the Implementation Plan] does not affect the management, assessment, or goals of fisheries that occur outside of the Wenatchee River basin. Low numbers of Wenatchee spring Chinook are harvested in ocean and lower Columbia River fisheries. Ocean fishery impacts are regulated under authority of the Pacific Salmon Commission and the Pacific Fishery Management Council. Fisheries under these jurisdictions have been reduced in recent years in response to ESA listings. Mainstem Columbia River fisheries are regulated under a co-management framework pursuant to litigation in US v Oregon. The 2008-2017 United States v Oregon Management Agreement provides the harvest management framework for spring Chinook fisheries below McNary Dam. The harvest schedule is designed to allow some level of harvest while protecting the great majority of ESA-listed NOR adults passing through the fisheries. Allowable harvest rates are scaled to the abundance of the total run destined to pass Bonneville Dam and the abundance of NOR spring Chinook projected to enter the Snake River. The allowable harvest rates for Treaty and non-Treaty fisheries are designed to achieve a 50/50 sharing of harvestable fish in the non-selective tribal fisheries and mark-selective non-tribal fisheries in accordance with treaty fishery case law standards. Total allowable fishery impacts in combined mainstem fisheries range from <5.5% on total runs of less than 27,000 to a maximum of 17% on runs of 488,000 or more. This implementation plan does not alter the management, assessment, or goals of fisheries that occur downstream of the Wenatchee River basin.

In addition to determining which PNI level to manage for, pre-season tributary run size estimates (forecasts) will be used to determine if 'safety net’ hatchery returns are likely to be in excess of what is necessary to promote recovery of the natural population. Pre-season forecasts will be refined using in-season updates based on counts at dams, traps, and/or other monitoring locations (e.g., PIT tag detectors). This will be important so proper planning can be made as to the disposition of the fish once they reach Tumwater Dam.”

3.4) Relationship to habitat protection and recovery strategies.

At the watershed scale, analysis such as the Washington State Conservation Commission's Limiting Factors Analysis (LFA), and technical tools including Ecosystem Diagnosis and Treatment (EDT), and SSHIAP (Salmon and Steelhead Inventory and Assessment Program) will be used to identify factors that currently impact salmon and to prioritize actions needed in the watershed. Degradation of remaining spawning and rearing habitat continues to be a major concern associated with urbanization, irrigation projects and livestock grazing along riparian corridors. Mainstem passage through hydroelectric projects and ocean survival conditions are major determinants of productivity for spring Chinook salmon within the ESU. The White River supplementation program and the natural spawning aggregation in the White River will benefit from any habitat improvement affecting spawning, rearing, or migratory locations used by the population. Coordination between the White River program and numerous regional habitat and recovery planning efforts is provided via members of the PRCC who participate in concurrent regional fish and wildlife planning, especially through the Upper Columbia Salmon Recovery Board (UCSRB), FERC relicensing activities, and the ICBTRT. The ICBTRT has the main task of establishing biologically based viability criteria for application to ESUs of salmon and steelhead under the ESA. The ICBTRT has described criteria for habitat viability and habitat usage in the context of spatial distribution and diversity of listed populations. Three HCPs have been adopted in FERC re-licensing agreements for operation of hydropower projects in the Columbia River mainstem. These HCPs have the potential to provide improved habitat and contribute the recovery of the White River and other subpopulations of spring Chinook within the Upper Columbia ESU.

The Biological Opinion established a habitat conservation account with annual funding of $288,600 to be used to finance tributary and mainstem habitat funding projects, which includes the White River. Annual habitat contributions of $807,900 are also available through the Priest Rapids Project Salmon and Steelhead Settlement Agreement (SSSA 2006). Additionally, the SSSA requires annual contributions to a No Net Impact (NNI) fund – an amount based on survival percentages of covered species. All three funds are administered and allocated through the PRCC or its Habitat Subcommittee. As of the end of 2008 the available habitat funds were (from the Priest Rapids Coordinating Committee Habitat Subcommittee 2008 Annual Summary):

No Net Impact Fund	$3,792,220.00
Habitat Supplemental Fund	$1,858,084.00
Habitat Fund (BiOp)	$503,564.00
Total	**$6,153,868.00**

Six fish and wildlife plans (also known as "subbasin plans") have been developed for the following "subbasins" (commonly known as watersheds): Wenatchee, Entiat, Lake Chelan, Methow, Okanogan, and the mainstem Columbia River from Rock Island Dam to the Canadian border. These subbasin plans were submitted to the Northwest Power Planning Council in 2004 and were subsequently adopted and included in the Columbia River Basin Fish and Wildlife Plan (NWPPC 2009). These subbasin plans reflect local policies and priorities while remaining consistent with the basinwide vision, biological objectives, and strategies. The plans will identify and provide the basis for prioritizing project proposals to be submitted to the Northwest Power Planning Council in future funding cycles and will be used, potentially, for salmon recovery planning in North Central Washington.

The Upper Columbia Salmon Recovery Board's Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (UCSRB 2006) was developed to help guide federal agencies charged with species recovery. The mission of the UCSRB is to restore viable and sustainable populations of salmon, steelhead, and other at-risk species through collaborative, economically sensitive efforts, combined resources, and wise resource management of the upper Columbia region. Consistency of the current White River supplementation program with objectives of ESU recovery planning and Priest Rapids Project mitigation objectives will be the goal of the PRCC.

Reasonable and Prudent Alternative actions have been proposed for the Federal Columbia River Power System (FCRPS) that "avoids jeopardy and adverse modification of critical habitat" (NOAA Fisheries 2008). These actions consist of objectives and strategies in the areas of adaptive management, hydropower, habitat, hatcheries, predation, and monitoring and evaluation. They target 13 ESA listed anadromous species.

Hydro actions proposed are:
- Hydropower Strategy 1— Operate the FCRPS to provide flows and water quality to improve juvenile and adult fish survival.
- Hydropower Strategy 2— Modify Columbia and Snake River dams to maximize juvenile and adult fish survival.
- Modify Columbia and Snake River dams to achieve biological and water quality performance standards.
- Hydropower Strategy 3— Implement spill and juvenile transportation improvements at Columbia River and Snake River dams.
- Hydropower Strategy 4— Operate and maintain facilities at Corps mainstem projects to maintain biological performance.

Proposed habitat actions:
- Habitat Strategy 1—Protect and improve tributary habitat based on biological needs and prioritized actions.
- Habitat Strategy 2—Improve juvenile and adult fish survival in estuary habitat.

Proposed predation actions:
- Predation Management Strategy 1—Implement piscivorous predation control measures to increase survival of juvenile salmonids in the lower Snake and Columbia rivers.
- Predation Management Strategy 2—Implement avian predation control measure to increase survival of juvenile salmonids in the lower Snake and Columbia rivers.

- Predation Management Strategy 3—Implement marine mammal control measures to increase survival of adult salmonids at Bonneville Dam.

As an example of the levels of benefit that may be attained through FCRPS actions, UCR spring Chinook may see a juvenile in-river survival increase of 9.5% over current rates (NOAA Fisheries 2007).

3.5) Ecological interactions.

If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Describe salmonid and non-salmonid fishes or other species that could:

During the captive rearing phase, program fish would not be affected by or affect other species. Progeny of captive brood, and fish from adult-based supplementation will however, be released as yearling smolt, at which time they may interact with White River naturally rearing spring Chinook or other species.

<u>(1) negatively impact program;</u>

Progeny of captive brood, and fish from adult-based supplementation will be released as yearling smolts at which time they may interact with White River natural-rearing spring Chinook salmon or other species. Spring Chinook salmon smolts are released in the spring as mostly yearlings, although other life stages could be released depending on the success of the captive brood phase and program requirements. Competition for food may play a role in the mortality of liberated Chinook salmon. Predation in freshwater areas also may limit the productivity of the spring Chinook releases. In particular, predation by northern pikeminnow (SIWG 1984) and bull trout pose a high risk of significant negative impact on productivity of enhanced Chinook salmon. Non-native species such as smallmouth bass also pose ecological risks to Chinook salmon (Sanderson et al. 2009).

<u>(2) be negatively impacted by program;</u>

Hatchery-reared salmon and steelhead released into spawning and rearing areas of natural species may fail to emigrate (residualize), creating a potential negative interaction with natural fish. Yearling spring Chinook salmon may eat young salmonids if they residualize or as they migrate downstream (Pearsons 2008, Pearsons et al. 2008). SIWG (1984) reported that there is a high risk that enhanced Chinook salmon populations would negatively affect the productivity of Sockeye in freshwater and during early marine residence through predation. The risk of negative effects to wild fish posed by hatchery Chinook through competition is low or unknown in freshwater and marine areas (SIWG 1984) Large concentrations of migrating hatchery fish may attract predators (birds, fish, and seals) and consequently contribute indirectly to predation of listed wild fish (Steward and Bjornn 1990, Pearsons 2008). The presence of large numbers of hatchery fish may also alter wild salmonid behavioral patterns, potentially influencing their vulnerability and susceptibility to predation. The potential also exists for diseases such as BKD to be transferred from hatchery-reared fish to natural populations.

<u>(3) positively impact program;</u>

Increased numbers of Chinook and other salmonid species that escape to spawn in upper Columbia River tributaries may contribute nutrients to the system upon dying that would benefit spring Chinook and listed steelhead productivity. .

<u>(4) be positively impacted by program.</u>
Spring Chinook juveniles released may benefit other species in several ways:

- A mass of hatchery fish migrating through an area may overwhelm established predator populations, providing a beneficial, protective effect to co-occurring wild fish (e.g., Fritts and Pearsons 2008).
- Chinook eggs, fry, and smolts (natural and hatchery) will increase the availability of prey, providing increased food supply for aquatic species including steelhead and Bull trout (Pearsons and Hopley 1999). As stated in the USFWS Biological Opinion on the Effects of the Priest Rapids Hydroelectric Project (USFWS 2007), the primary impact of the spring Chinook supplementation program on Bull trout "may be beneficial" due to the increased availability of prey in the form of migrating smolts (see Addendum A). Other bird, fish and mammal species may benefit in a similar way.
- Increased numbers of spring Chinook that return and are allowed to spawn naturally may contribute important ocean-derived nutrients to the system upon dying that would benefit the productivity of other listed salmonid species (Quinn 2005). Juvenile steelhead, for example, congregate in areas where salmon carcasses are deposited and show a dramatic increase in condition factor (Bilby et al. 1998).
- Increased numbers of spring Chinook that return and are allowed to spawn naturally reduce the short-term genetic extinction risks to the White River MaSa associated with both inbreeding by White River origin adults and outbreeding with other stocks.
- Indirect positive impacts include strengthened justification for developing regional habitat conservation measures protecting all fish species.

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SECTION 4. WATER SOURCE

4.1) Description of the water source.

Juvenile-based Captive Brood:

Little White Salmon National Fish Hatchery Complex (Little White Salmon NFH) - Water source is from the Little White Salmon River and springs. New well water sources have been developed to be combined to increase water temperatures during the early rearing of Little White Salmon Chinook programs during the early spring (approximately 48° F) compared to the colder river source (mean 44° F). Water temperatures range from 45º in the spring to 47.5ºF during the summer and fall months, while the coldest temperatures occur during January (41ºF). The river supplies most of this water flow. For pathology concerns, no anadromous fish are upstream of the water source although some resident species occur (personal communication S. Doulos 2006).

Water chemistry parameters shall be well within acceptable ranges for rearing spring Chinook captive broodstock. Total dissolved gas, hardness, and pH are routinely monitored. Hardness and pH are within accepted fish health criteria. Water chemistry is evaluated annually by a professional laboratory and all parameters are within accepted fish rearing criteria.

F2 generation Captive Brood Phase - Transitional, Alternate and Proposed Rearing/ Acclimation Sites:

Little White Salmon National Fish Hatchery Complex (Little White Salmon NFH) – See description for juvenile-based captive brood above.

Lake Wenatchee Net Pen Rearing - The confluence of the White River with Lake Wenatchee is less than ¼ mile from the net pen location. The net pens rely on passive flow through the structure and do not withdraw water. Past lake water temperature readings during spring rearing programs from 1997–1999 indicated water temperatures ranging from a low of 38.6º F to a high of 41.5º F in April and a range from 40.8º F to 45.5ºF in May. Early summer temperatures will elevate to a range of 55ºF – 66.5ºF and increase to 69.8ºF by early fall. The proposed rearing timeframe will release fish during May before temperatures elevate. Rearing densities will be kept low (<0.25lbs/per ft^3 or <.047 lbs/cf^3/inch).

Adult-based Supplementation:

Alternative facility locations, designs, and water supply systems are currently being evaluated. Rearing is proposed to occur at the Little White Salmon NFH (see above). Various options are being considered for brood capture, including capture at Tumwater Dam and trapping in the White River. Trapping and holding water will be supplied by the rivers that the capture systems are located in.

An adult holding and early egg incubation facility option is proposed at the Boyce property on Nason Creek. Water conditions at this new site are discussed in the Upper Columbia River Spring-run Chinook Salmon – Nason Creek Supplementation Program HGMP. This option is currently being discussed by the HSC.

An over-winter acclimation site is being evaluated at the McComas property on the lower White River. Water will be pumped from the White River and wells will supply tempering water that will be injected over the river intake screens to allow reliable winter operation.

Specific flow requirements for rearing and acclimation facilities are discussed in section 9.2.2, Rearing Criteria.

General water quality guidelines will apply to the evaluation of all water supplies. The availability of pathogen free ground water is important for fish health during early rearing and surface water helps match natural growth profiles during extended rearing. Both supplies should be of appropriate quantity and quality. Parameters to consider when evaluating the water rearing environment include turbidity, dissolved gases, heavy metals, hardness, pH, and the potential for contamination. Very high turbidity levels (above 100,000 ppm) may cause problems such as gill irritation for fry; reduced growth rates when fish visibility is limited; and silt removal problems (low and moderate turbidity levels are not detrimental and may reduce stress). Air super-saturation, high dissolved carbon dioxide/low oxygen levels in groundwater (assumed for all supplies and easily corrected), and the presence of dissolved hydrogen sulfide are potential gas issues. Heavy metals are generally introduced to water through improper facility construction; however, natural supplies can also contain them. Sensitivity of fish to toxic pollutants, including metals, increases at low alkalinity. Chemical spills from truck accidents, agricultural pesticides, and herbicide applications are other sources of water supply contamination. Suggested upper limits for many of quality parameters are listed in Piper (1982) and in the Alaska Fish Culture Manual (ADFG 1986). Due to the interactive aspects of chemical reactions in water, developing specific criteria is difficult. Most water supplies have some values outside these limits, yet Chinook are successfully reared in a variety of conditions throughout the Northwest. The standards can be used as general guidelines, but quality determinations will not be made until testing with live fish is completed.

4.2) Risk aversion measures used to minimize the take of listed fish.

<u>Juvenile-based Captive Brood:</u>
The water supply for captive broodstock rearing is surface water from the Little White Salmon NFH. There is no natural spawning spring Chinook salmon in the Little White Salmon River so there is no risk to listed species.

<u>Adult-based Supplementation:</u>
Adult-based facilities are being designed. Intakes will conform to NMFS and WDFW requirements for design and operating criteria and to Department of Ecology water use permits identifying approved flow volumes. Effluent management will conform to

NPDES permit requirements. Other risk aversion measures will include backup power for pumped water supply systems, predator exclusion, flow and water level alarms, and emergency release capabilities for cases of loss of water and flooding.

F2 generation Captive Brood Phase - Captive progeny rearing/acclimation proposed sites:
Little White Salmon NFH water supply risk aversion measures include:

- An intake structure that meets NMFS screening criteria.
- An automatic alarm system with sensors at the intake, incubators, and rearing units.
- Daily monitoring of water temperatures and reporting of any unusual fish behavior or culture incidents to hatchery supervisors (personal communication S. Doulos 2006).

Lake Wenatchee Net Pen Rearing: In the near term, fish to be reared to yearling size for release will be held for acclimation in net pens in Lake Wenatchee. Total on-site production and feed fed monthly will remain under permit limits. The net pen site plan and operational procedures for regular and emergency procedures will minimize impact to the lake environment and resource. Net pen mesh sizes are managed to allow maximum passive water exchange through the individual pens for optimum fish health and water chemistry concerns (dissolved oxygen, etc.) while keeping fish constrained within the pen system until they reach smolt or program size for release. No detectable changes in water quality has been associated with the net pens and water quality is largely influenced by the White River (Anchor QEA 2009).

SECTION 5. FACILITIES

As directed by the Biological Opinion for ESA Section 7 Consultation on Interim Operations for the Priest Rapids Hydroelectric Project (NOAA 2004), facilities will be capable of meeting the programmed production objectives plus a 10% increase in capacity: 165,000 smolts.

Spawning, incubation, and rearing activities currently occur at the Little White Salmon NFH for the captive brood program and are anticipated to continue there . Acclimation sites for F2 progeny and program facilities needed for the adult-based supplementation program are being designed.

Draft design objectives have been developed and will be used to guide technology selection, site location, and construction (where needed) of the facilities. The different program components are: brood capture, brood holding, rearing, and acclimation. Objectives common to all the components that will be used during siting and design are as follows:

Low Environmental Impact - the potential environmental impacts of proposed facilities will be reviewed in detail during the NEPA, SEPA, ESA, and site permitting processes and will be considered during siting and design. Impacts may occur to plant and animal species in the air, water and land. Surface water withdrawals will impact streams for the distance between the removal and the return. Groundwater use can affect users within the area of influence of wells and infiltration galleries. Other environmental and permit considerations include local land use zoning codes, aesthetics, flood impacts, cultural resources, receiving water quality standards, and wetlands impacts.

Flexibility – allowing program managers the option of making future changes to the fish culture program in response to the adaptive management process will be considered during location and design.

Low Failure Risk – surface water supplies will need to function reliably in all river conditions, including icing, high flow, low flow, and during times when debris loads are heavy. Surface and ground water pumps, where needed, must have generator back up and alarm systems.

Functionality – land availability, utilities, and access are other site considerations.

Studies discussed in the following sections demonstrate the impact of facilities and culturing practices on survival rates. The general importance of the rearing environment is apparent when comparing the high adult return rates of genetically similar fish reared in the wild against those reared in hatcheries. Culturing conditions are proposed for the White River supplementation project that attempt to produce smolts with “wild” characteristics.

The table below summarizes the approximate facility water and space needs for the 165,000 smolt White River program. The calculations assume that all White and Nason broodstock are held at one location, an option being considered. They also assume that surface and ground water temperatures at the facilities are typical of those found in the area and that the White River fish are reared up to November before being moved to overwinter acclimation sites. The flow calculations do not include safety factors, they are minimums and are based on the criteria shown in section 9.2.2. The values should be increased by factors that depend on the reliability of the water supply systems that are used. The space calculations are based on criteria for progeny of 100% high-BKD parents. Space requirements for acclimating progeny of low- BKD parents is considerably lower at 14,667 cf.

Table 11. Flow and space hatchery targets for the White River spring Chinook salmon population based on assumed egg incubation of 203,700 eggs (~81.0% unfertilized egg-to-release survival) from 52 females (~90% transfer-to-spawning survival and 4,400 eggs/female) and 55 males (~85% transfer-to-spawning survival and 1-to-1 spawn ratio) held in 8 cf/fish with a flow of 1 gpm/fish, transfer of 173,700 fish (~95% transfer-to-release survival) from rearing at 25 fpp (~5.13 in), and acclimation release of up to 165,000 fish at 15 fpp (6.08 in).

	Peak Minimum Flow (cfs)	*Water Type*	*Peak Minimum Space (cf)*
White River portion of broodholding/incubation	0.24	Ground / Treated Surface	856
Rearing, low BKD (FI=0.75, DI=0.125)	4.0	Ground / Treated Surface	10,835
Rearing, high BKD (FI=0.60, DI=0.060)	5.0	Ground / Treated Surface	22,573
Final acclimation/release (FI=0.60, DI=0.060)	6.7	Surface	30,154

5.1) Broodstock collection methods.

Juvenile-based Captive Brood:

White River spring Chinook required to continue the captive brood phase will be obtained through removal of a limited number of eyed eggs and pre-emergent fry from selected redds in the drainage using standard hydraulic sampling methods (Young and Marlowe 1995). White River spring Chinook typically spawn between the second week in August and the fourth week in September. Redds will be identified during routine spawning surveys and their positions triangulated for subsequent sampling of eyed eggs and pre-emergent fry. Marked hatchery adults from other tributaries will be identified and redds on which they have spawned will be cataloged and precluded from collections to assure the genetic basis for the White River population. Redd sampling will occur between approximately September 9 and November 19. Pedigree studies will be used to confirm the origin of parents. The PRCC HSC will use the pedigree information to select which individuals will be retained for broodstock. Fish not retained for broodstock will be released with the second generation yearling smolts.

Adult-based Supplementation:

A brood collection strategy utilizing parental based tagging is proposed by the co-managers (see section 7.3), but this approach has not been approved by the HSC.

Returning adults are trapped, PIT tagged, genetically sampled, and released at Priest Rapids Dam. While migrating to the Wenatchee basin, the genetic samples will be processed and used to determine the spawning area of origin. Adults will be re-trapped at Tumwater dam, where decisions about brood management will occur. The draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009) provides facility details:

“Off-ladder Adult Fish Trap” Operations
We [WDFW and YN] propose to test the feasibility of the parental-based tagging-based broodstock collection protocol in 2010 by running the Priest Rapids Dam (PRD) Off-Ladder Adult Fish Trap for two or three 1-3 day periods to verify the following assumptions:

- Continuous operation of the Off-ladder Adult Fish Trap on the left bank fishway will not change the proportion of the spring Chinook run using the LB fishway; this will be determined by comparing the relative percentages of ladder use during Off-ladder Adult Fish Trap test periods with those between test periods. The test is considered successful if LB ladder use remains at 85% or higher during continuous operation of the Off-ladder Adult Fish Trap.
- Approximately 60% of the fish passing PRD are destined for the Wenatchee River based on relative PIT tag detections between RRD and RIS.
- The “conversion rate” of PIT-tagged Wenatchee adult spring Chinook from PRD to Tumwater Dam is at least 90%.
- Very few or no fish will arrive at Tumwater Dam in less than 10 days.

Tumwater Operations.
Parental assignment rates.
For parental-based tagging to be used successfully to manage Wenatchee Basin spring Chinook salmon, we [WDFW and YN] need to ensure that we can:

- Determine the MaSA of origin at Tumwater Dam to meet the escapement and spatial distribution objectives, and
- Estimate the proportion of fish we [WDFW and YN] are able to ID to enable brood collection at a given extraction rate per MaSA to avoid over-extraction in any sub-population.

An exercise was developed to give us an understanding of how this could be accomplished. This exercise used the following steps:

- Based on PIT-tagged spring Chinook conversion rates from 2008, approximately 83.3% of Wenatchee natural origin spring Chinook sampled at PRD are expected to arrive at Tumwater Dam.
- Of the sampled fish arriving at Tumwater Dam we [WDFW and YN] predict a 90% assignment success to at least one parent using a 15-allele database (Ken Warheit [WDFW] and Michael Ford [NMFS] pers. comms.).
- Through a combination of existing remote PIT tag detection antenna arrays within each of the tributaries (Nason Creek, Chiwawa River, White River, and Little Wenatchee River), and detections of individual spawners during spawning ground surveys, we [WDFW and YN] anticipate that up to 80% of the parental generation

will be identified to stream of origin. At this time we [WDFW and YN] cannot detect released PIT-tagged spawners in the upper mainstem Wenatchee River. This MaSA constitutes a small percentage of the whole population and are predominantly hatchery origin fish.

Based on these rates, we [WDFW and YN] anticipate that the stream of origin (MaSA) can be identified for up to 61% of the total run of NOR adult progeny returning to Tumwater Dam. Actual rates will likely vary annually. Unidentified NORs will be released to continue upstream.

<u>Escapement Management at Tumwater Dam</u>

Escapement goals will be developed annually based upon the pre-season run forecast and appropriate PNI level. In-season adjustments to the Escapement Goal and/or target PNI may be necessary. Draft escapement goals for the White River are 217 at Tumwater Dam and 141 to the White River. Abundance of natural origin spawners will not be restricted – only those of hatchery origin. A sliding scale of PNI relative to run escapement will be used. Higher PNI will be achieved when natural run abundance increases.

We [WDFW and YN] plan to manage escapement past Tumwater Dam in a similar manner as we plan to manage pNOB within the broodstock; through a combination of weekly escapement goals to be filled with NORs and then back filled with HORs as appropriate to achieve PNI targets.

1. Based on forecasted run size, a target PNI level will be chosen. Based on the target PNI level, weekly escapement goals will be developed. In-season check-ins will be used to ensure that the selected PNI level is appropriate.
2. All NORs not collected for broodstock will be passed upstream of Tumwater Dam.
3. Weekly escapement goals based on PNI targets will be used to determine how many HORs to pass upstream of Tumwater (HOR = Weekly Escapement Goal – NOS).
4. Starting with week one, passed NORs will count towards the weekly escapement goal. Any deficit in meeting the goal will be collected the following week.
5. The escapement deficit will be made up the following week with HORs or NORs (if available in excess of weekly escapement goal while maintaining the target extraction rate for broodstock). The deficit will accrue if not filled.
6. To prevent overseeding of any particular MSA, known MSA NOR fish passed above Tumwater will be counted towards that particular MSA. Unknown MSA NOR fish passed upstream of Tumwater will be counted towards each MSA proportionately to the mean spawning distribution for the brood years representing 3, 4, and 5 year old NORs.
7. While working within the weekly escapement goals, the numbers of HORs from each program which are passed upstream will be dependent upon the escapement goal for the MSA and the number of NORs for each MSA that have been passed.
8. If NOR fish have been passed in excess of weekly escapement goals, use the

cumulative escapement distribution to determine when and how many HOR fish may need to be passed at a later date."

The WDFW and YN have identified the parental-based tagging strategy as their preferred approach for collectively managing the production components within the Wenatchee Basin but also propose that other alternative strategies such as Merwin traps and fish wheels be investigated for potential use as broodstock collection strategies in the White River. Fish wheels have the advantage of being relatively easily removed during the off season. They also pass a percentage of the run without impact. However, their effectiveness and ability to select representative brood are undetermined. Merwin traps consist of a complex net system hung in the water that direct fish to a trap. They can also be easily removed and will pass a percentage of the run without impact. They work best in lacustrine environments and may work in the low velocity, turbid conditions of the lower White River. Further analysis of these methods will help determine their effectiveness and potential environmental impacts. Other techniques such as microelement, microarray, and multivariate analysis will also be considered.

5.2) Fish transportation equipment.

Juvenile-based Captive Brood:

Eggs and Fry - Eyed eggs are transported in small buckets or custom-designed cylindrical tubes resting on insulating material over ice within a cooler. Alevins and fry are transported in heavy duty freezer bags partially filled with water and inflated with oxygen. Bags are placed on a layer of insulation over ice within a cooler.

Juveniles - Pre-smolts are transferred from rearing locations (i.e. Little White Salmon NFH) to the White River acclimation facilities in tanks designed for juvenile fish transport. Program fish will be acclimated to the receiving water by tempering of water temperature differences between the tanker truck water and the receiving water (no greater than 3^0F/hr). Density, sodium (0.5%), loadings, temperature, and dissolved oxygen criteria are defined prior to transport and monitored during the transfer.

Adult-based Supplementation:

Adults – Adults will be transported from trapping facilities to adult holding facilities. Transport tanks will be designed for adult transfer and will operate within criteria provided by fish health and fish culture professionals.

Eggs and fry – In the event of transport, protocols will follow those described above.

Juveniles – Fingerling or pre-smolt spring Chinook will be transported from the rearing location to acclimation/release ponds on the White River. Fish will be transported in tanks designed for juvenile fish transport. Protocols will follow those described above.

5.3) Broodstock holding and spawning facilities.

Juvenile-based Captive Brood:

Captive broodstock are presently reared at the Little White Salmon NFH in 10'x110' outdoor raceways. Upon maturation, they are transferred to 8'x80' indoor raceways with a total volume of 1547 ft^3 and spawned in that indoor facility.

Adult-based Supplementation:
Design criteria are for 10 cubic feet of volume and two gpm of flow per adult. Surface and groundwater will be supplied to the holding ponds in a manner that will facilitate maintenance of adult holding temperature below 55^0F. Designs will allow crowding and sorting of fish by gender, ripeness, etc. Spawning will occur at a dedicated bio-processing area adjacent to the adult holding facilities. The area will be supplied with water, concrete slab flooring with wash down drain, buckets, troughs, and laboratory supplies to support fish health sampling and fertilization.

Locations that will accommodate both White River and Nason Creek broodstock are being evaluated for this facility. Sites in the Wenatchee basin which are relatively close to the adult traps, such as the Boyce property on Nason Creek (see the Upper Columbia River Spring-run Chinook Salmon – Nason Creek Supplementation Program HGMP for site details), are being given priority in order to reduce logistical complexity and adult stress. Incubation of eggs to the eyed stage is a program function that may be included at such a facility.

5.4) Incubation facilities.

Up to ten half stacks (eight trays) of vertical incubators are used at the Little White Salmon NFH facility. The vertical stack incubators are supplied with 5 gpm of water each. Water temperatures during incubation are approximately 48^0F. Iso-buckets temporarily installed in shallow troughs may be used during early incubation while viral and disease screening is completed.

5.5) Rearing facilities.

Juvenile-based Captive Brood:
Fish are reared at the Little White Salmon NFH in 10’ by 110’ by 3.5’ deep concrete raceways.

F2 generation Captive Brood Phase:
Fish are reared at the Little White Salmon NFH in 10’ by 110’ by 3.5’ deep concrete raceways. In 2009, five raceways are being used for this program, each having 3,850 ft^3 of rearing space. As a result, a total of 19,250 ft^3 of raceway space is available for the final rearing of White River spring Chinook.

Adult-based Supplementation:
It is anticipated that fish will be reared at the Little White Salmon NFH in 10’ by 110’ by 3.5’ deep concrete raceways. If new facilities must be identified or constructed, then objectives for the new facility will include:

- High Quality Fish
    - Water Quality – see section 4.1. Ground water is preferred for early rearing.

- Rearing Criteria – this highly valuable stock will be reared using low volume density, which is critical for Chinook, and low flow volume density criteria (see section 9.2.2).
- Rearing Environment – large scale experiments with spring Chinook at the Cle Elum Supplementation and Research Hatchery have not demonstrated advantages in survival due to the use of some rearing strategies. Painted walls, floating covers, and subsurface feed introduction did not substantially improve adult survivals when compared with standard raceways (BPA 2005). Rearing criteria and water conditions will be more important factors in designing the rearing environment than these strategies.
- Fish Health – the susceptibility of Chinook to BKD will be a critical program design consideration. Rearing systems, water quality, and site locations that can minimize disease effects will be used.

- Flexibility – an example of design flexibility is having enough of both ground and surface water available to operate the rearing program, allowing any combination of water supplies to be used.
- Low Failure Risk – rearing sites must capable of managing power failures, snow and ice accumulation, as well as flood risks.
- Functionality – designs need to incorporate the fish culture procedures required at hatcheries. Rearing units are frequently cleaned and must accommodate effective feeding practices, disease treatments when needed, vaccination, tagging, and the removal of fish to acclimation sites. Outdoor rearing units need to be fenced and covered with bird exclusion wiring to reduce predation. Shade cloth will be incorporated where summer temperatures and general stress levels need to be reduced.

Several alternatives that meet some or all of these objectives are being considered for rearing facilities. Continued rearing at the transitional hatcheries as well as construction of new facilities at sites within the Wenatchee watershed are options.

5.6) Acclimation/release facilities.

Juvenile-based Captive Brood and Adult-based Supplementation:
Acclimation facilities adequate to contain 165,000 smolts are required for release of second generation smolts produced from captive broodstock spawning or adult-based supplementation phases. It is anticipated that the acclimation site will be the same for both phases of the program. Objectives used to determine the location and design of new acclimation sites are as follows:

- High Adult Return Rates
  - Methods that have been shown to produce smolts with improved survival rates involve natural rearing conditions. An important environmental component for acclimation is surface water. The cold winter and warming spring temperatures of surface water encourage smoltification (Appleby et al. 2002) and produces fish that are motivated to migrate quickly. Also, acclimation sites with surface water will allow a more natural growth profile to be followed (see section 10.1).
  - Chinook smolt-to-adult survival rates increase when rearing occurs at low volume

densities (Ewing et al. 1995). A study using raceways showed a 4x increase in survival when comparing Chinook reared at 1 lb/ft^3 vs. 3 lbs/ft^3 (Banks 1994) and there was not a significant difference in survival rates due to changes in flow density. Sites that have room to allow large, low density rearing units will have priority.

  - A third method of improving smolt survival is overwintering at the release site. Paired releases of summer Chinook salmon in the Mid-Columbia (Wenatchee, Methow, and Similkameen) have shown significantly higher smolt-to-adult return rates for fish acclimated on river water for seven months over those acclimated for two months. Over the five year study, the overwinter acclimation period typically resulted in a 200% increase in smolt-to-adult return (SAR) rate (A. Murdoch unpublished data).
  - Hauling has a negative impact on fish and on smolts in particular. However, the most stressful event in the trucking process is loading (Maule et al. 1988) so trucking distances are not the major contributor to negative impacts. Acclimation (and rearing) systems should minimize the number of times fish are hauled.
  - Studies have shown a survival benefit of rearing in ponds when compared to raceways, as demonstrated for Coho (Fuss 2002), cutthroat (Tipping 2001), and spring Chinook (Beckman 1999).
- <u>Low Environmental Impact</u> – current National Pollution Discharge Elimination System (NPDES) policy allows the administering agency, Washington Department of Ecology (WDOE), to waive the requirement for a discharge permit if production gains at a specific site are less than 20,000 pounds per year or food fed is less than 5,000 lbs per month and if impacts are considered minor. The upstream acclimation sites will be well under these limits. However, WDOE is concerned with the cumulative impact of multiple acclimation sites in the region. Permits may be required in the future, which at a minimum may involve water quality monitoring. It is also possible that waste treatment procedures may be implemented. Also, where possible, the acclimation sites will be environmentally beneficial. Natural acclimation ponds and habitat restoration on land that is purchased for acclimation can benefit a variety of species. Sites will be designed so that when acclimation is no longer being conducted, they can be restored to a natural condition.
- <u>Low Stray Rates</u> – fish that migrate in their natal stream for long distances stray less than fish that move short distances (Garcia et al. 2004). Release locations should then be as far upstream as practical. In 2007, 82% of all spawning occurred above the Napeequa confluence (Hillman et al. 2009). Also, acclimation on surface water will also help imprint smolts to unique White River water characteristics.
- <u>Flexibility</u> – release locations, release numbers, and acclimation technology may change in the future. Systems that can adapt to these changes are preferred.
- <u>Functionality</u> – sites need to be accessible for fish delivery, feeding, and maintenance.

Several methods are possible for final acclimation/release. Direct truck planting of smolts is not preferred because of low survival rates and the potential for high stray rates (Johnson et al. 1990 and Labelle 1992). Concrete raceways will not be used because they reduce program flexibility and do not fit into the natural landscape of the White River.

Engineered natural habitats show promise but have not yet been fully tested. Remaining options include constructed ponds and acclimation in existing river side channels.

Overwinter acclimation in large ponds at accessible upstream areas using surface water is an optimal acclimation system. However, such locations have not been found in the White River watershed. A compromise system involving overwinter acclimation at a site low in the basin is being evaluated.

Current plans are for a long-term acclimation facility on Grant PUD owned property (i.e. McComas short plat) at approximately RM 1.1. Planning and site evaluations for design and construction are advancing but facilities are not yet available. Conceptual plans for this site include three naturalized pond that will be used to rear and acclimate fish on surface water from November through May of each year. Fish will be acclimated at alternative locations (e.g. net pens or natural features) until this facility is operational.

F2 generation Captive Brood Phase Transitional Acclimation/Release Sites:
Releases during 2004 and 2005 included temporary acclimation at the Tall Timbers Ranch site so that 2,589 smolts could be released into the White River. During spring 2006, approximately 1,654 yearling (BY 2004) White River spring Chinook were planted in the White River at a log jam site located at approximately RM 6.5. This structure is approximately 50 meters from the White River Road. The complexity of cover at this site provided protection from high flows and allowed for dispersal and predator avoidance.

Beginning in 2007, captive brood progeny were acclimated and released from the Lake Wenatchee net pens (RM 91.0 Lake Wenatchee/Wenatchee). Fish were reared from fingerling to yearling stage at Little White Salmon NFH, transferred to the net pen complex in March of 2007, and released to the lake in May 2007. A similar approach was used in the spring of 2009. There are eight floating net pens for juvenile rearing. Six pens are 20 ft x 20 ft x 16 ft and two pens are 16 ft x 16 ft x 20 ft. The pen complex is located on the west end of the lake adjacent to the mouth of the White River. During 2008, appropriate permitting was not received timely enough to install the net pens before the necessary acclimation timeframe. To avoid the risk of the fish imprinting on the Little White Salmon River, 142,033 yearlings were released directly into the White River during March 18 and 20, 2008. To avoid interaction with natural origin juveniles, fish were split equally among two release sites in the lower river (approximately RM 1.1 and 3.5). It is anticipated that the net pens will be used for a majority of the acclimation and releases until the McComas site can be developed. If logistic issues or ice prevent installation of the net pens in future years, the most appropriate method of acclimation/release will be determined by the PRCC HSC.

5.7) Difficulties or disasters.
Fish quality and survival has been a continuing difficulty during the initial stages of implementation of the program. Mortality rates for captive brood have been high (80% from egg to adult), although within acceptable limits. Current survival data for the 2002-2005 BYs suggest that egg- to-spawn survival is improved over the 1997-2000 BYs and

is likely to meet the program expectation of 30% (See section 9.2.1). Rearing second generation fish at AquaSeed resulted in poor quality smolts. Second generation fish, beginning with the 2005 BY, are being reared at Little White Salmon NHF where smolt quality has been excellent. The quality of fish produced at the Little White Salmon NFH was a significant factor in the decision to transition the captive brood portion of the program to that facility. Between July 2008 and February 2009, the captive brood were transferred to the Little White Salmon NFH and all future captive brood will be reared at that facility.

5.8) Back-up systems and risk aversion measures.

Juvenile-based Captive Brood:

The facilities at the Little White Salmon NFH are protected by a number of systems from catastrophic loss to listed fish:

- Most water supplies are gravity flow
- backup generators to supply power to pumps for water supplies that require pumps.
- Water supplies have alarms to detect loss of flow and level.
- 24-hour on-call personnel with pagers and cell phones.
- Security fencing and burglar alarm system.
- All groups are reared at minimum pond loading densities to minimize the risk of loss due to disease and to maximize survival.
- Effluent water is treated with a chlorination/dechlorination system to protect all resources in receiving waters.
- All activities are conducted in accordance with the WDFW Fish Health Manual (WDFW 1996) and the Co-Managers Salmonid Fish Disease Control Policy (1997).
- All lots/groups of fish are separated according to disease certification status.

Adult-based Supplementation:

The proposed White River hatchery and acclimation facilities will be protected by at least the following:

- All sites with water pumps will have backup generators and alarm systems to assure continued electrical power in the event of power service failure.
- All water supplies and rearing vessels will have alarms for water flow and water level.
- Protocols will be in place to test standby generators and all alarm systems on a routine basis.
- All facilities will be staffed during operation to provide for protection of fish from vandalism and predation, and allowing for a rapid response in the event of power loss, water loss, or freezing.
- Fish collection facilities will be staffed as required during operations to ensure effective operation, safe capture and holding of fish, and to prevent poaching.
- Adult holding, incubation, and rearing facilities may be sited in areas that have a low flood risk.
- All groups will be reared at minimum pond loading densities to minimize the risk of loss due to disease and to maximize survival.
- All hatchery staff responsible for collection and propagation will be trained in proper

fish handling, transport, rearing, biological sampling, and accepted fish health maintenance procedures to minimize the risk of fish loss due to human error.

- All fish will be handled, transported and propagated in accordance with WDFW Fish Health Manual (1996), Co-Managers Salmonid Fish Disease Control Policy (1997), and Pacific Northwest Fish Health Protection Committee (PHFHPC 1989) model program.
- Hatchery effluent will conform to conditions of the National Pollutant Discharge Elimination System (NPDES) permit.
- Water supply systems will be redundant where possible. Dual pumps and generators, will be installed.
- Water intake systems will be screened according to NMFS and WDFW standards to prevent mortality from impingement or removal of listed species from the natural habitat.

<u>F2 Generation Captive Brood Phase Sites:</u>
Eastbank Hatchery and Little White Salmon NFH: The hatcheries incorporate the protection measures listed above, including back-up generators, alarm systems, redundant water supply systems, and 24 hour on-call staff.

Little White Salmon NFH: Upgrades to the original hatchery were made in 2001, including raceways enclosed by 1.5-inch mesh chain link fence and overhead aircraft cable space 6-inches on center to preclude entrance by both mammalian and avian predators. All raceways are equipped with aluminum baffles to maintain a self-cleaning environment and extra metal guides at the tail end to allow installation of double screens to prevent escapement of non-endemic fish into the Little White Salmon River. The entire upper raceway area is designed to facilitate loading of fish onto large distribution trucks for off-site transfer. In addition, conveniently located utility stations can accommodate a variety of fish marking trailers. Both Little White Salmon River and spring water are available at the upper raceways. Raceway cleaning is performed full length for un-baffled raceways, while baffled raceway cleaning involves flushing of the lower compartment. All waste from cleaning operations is diverted to the pollution abatement circular clarifier. Fish mortalities are removed and recorded daily and equipment is disinfected between individual fish lots. Water temperatures are monitored daily and any unusual fish behavior or culture incidents are reported to hatchery supervision (personal communication S. Doulos 2006).

Lake Wenatchee Net Pen Rearing: This program has an emergency plan for rapid response for protection of fish from risk sources (water pollution, etc.). The net pen complex is monitored frequently in case of weather problems. Fouling articles or debris are removed from net pens to prevent tearing. Multiple rearing units (net pens) are used for rearing. Densities are held to minimum loadings to reduce risk of rearing stress or disease. Sanitation – all equipment is disinfected between uses on different lots of fish and individual net pens including nets, boots, raingear, etc.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1) Source.

The proposed recovery program initially incorporated captive brood technology to rear progeny of natural origin spring Chinook spawners from the White River. Eggs or fry from naturally spawning White River spring Chinook are collected from redds and reared in captivity. The use of second generation fish (F2s) in the broodstock program may be required for augmenting deficiencies encountered during the collection of natural broodstock. The potential demographic boost from using F2 individuals in the captive broodstock program outweighs genetic risks (e.g., domestication selection, inbreeding depression) associated with two generations of captive rearing and one cycle of artificial spawning, assuming all efforts are made to prevent sibling matings (e.g., no within-brood-year matings) and to increase effective population size (e.g., factorial crosses). However, use of F2s in the captive brood is not a preferred option.

Broodstock for the adult-based supplementation phase will be a combination of hatchery and natural White River origin adults unless sufficient numbers of natural origin fish are available. Protocols for broodstock ratios are under development (see section 7).

6.2) Supporting information.

6.2.1) History.

The broodstock source for this program is the spawning aggregate of the UCR spring-run Chinook salmon ESU spawning in the White River, and tributary to the Wenatchee River (WRIA #45). The White River MaSa segment as well as all other segments within the ESU are endangered and at risk of extinction.

The White River spawning aggregation was one of three proposed for captive broodstock rearing to reduce the immediate risk of extinction (BAMP 1998). Eyed eggs were first collected from redds of naturally spawning adults in the White River in 1997. Egg collection has continued at varying levels for each ensuing year with the exception of 1999 and 2001. The number of eggs collected annually has ranged from 183 to 1,529. Prior to 2002, program uncertainty, impacts of hatchery strays, and access limitations to redds were limiting factors and restricted successful implementation of the program.

6.2.2) Annual size.

See section 2.2.2. Approximately 80 adults (40 females) are required to support a 150,000 adult-based smolt program, based on the latest life stage survival averages under culture. A 10% contingency add-on would require 88 adults.

6.2.3) Genetic or ecological differences.

There are no known genetic or ecological differences between the hatchery and natural components of the White River natural spawning aggregation. As of 2008, there has been no known natural spawning of adult returns generated by the captive broodstock program. However, evidence from the ongoing pedigree studies appear to indicate the presence of successfully spawning precociously mature males (Ford and Williamson 2008, Ford et al. 2009) that may be from hatchery releases. The M&E program will assess any changes to the natural population subsequent to the return of adults from the captive broodstock program. The program is designed to retain genetic and ecological traits of the listed target populations.

Phenotypic differences have been observed within captive broodstock at the time of spawning; age-at-maturity, size-at-maturity, and fecundity. Captive broodstock tend to mature at relatively younger ages when compared to natural spawners observed in the White River which mature exclusively at 4- (μ=67.1%) and 5-yrs (μ=32.8%) of age (M. Tonseth, WDFW, personal communication). Captive brood spawners from three stocks assessed over four brood years matured predominantly as 2-yr-olds (61.1%) followed by 3-yr-olds at 18.8%, 4-yr-olds at 16.9%, and 3.2% as 5-yr-olds. Male and female proportion for brood years 1997 through 2000 has been 85% and 15%, respectively. These shifts are thought to be phenotypic rather than genotypic due to the White River captive broodstock rearing receptacle container sizes, freshwater environment (as opposed to sea-water results) and growth rates (pers. comm. D. Witczak, 2005). However, chilled water was not available for these broods and growth rates could not be manipulated. Chilled water was used to retard the development of the eyed eggs and subsequently delay the ponding date for brood years 2006 and 2007. Chilled water has been effectively used in adult-based hatchery programs to reduce growth rates and early sexual maturation. As a result, broodstock currently being reared are expected to have an older mean age at maturity and more even sex ratio. It is expected that progeny of natural-spawning adults will display normal age distribution. The M&E plan will assess this assumption.

Fecundity of White River captive broodstock averaged 1,377 for brood years 2001-2007 and was 1,563 as broodstock survival increased for brood years 2005-2007 (Tonseth and Maitland 2008). Typical fecundity for UCR spring Chinook salmon is 4,400 (BAMP 1998). Average size of White River female spawners at age has been 1,628g (age 3), 1,987g (age 4), and 1,582g (age 5). These sizes are significantly smaller than natural-spawning adults which average approximately 15 pounds (6,800g) at maturity. These size and fecundity reductions are typical of those experienced among captive broodstock programs in the region (Murdoch and Hopley 2005). It is assumed that phenotypic traits for adults from the F2 releases will better approximate the natural population than did the captive brood adults, although may not mimic entirely age at return and sex ratios observed in the natural population. Evidence suggest that hatchery origin fish generally mature at an earlier age than the natural origin fish and this may be expected with hatchery returning adults from the White River supplementation program.

The Chiwawa hatchery stock, which strays into the White River watershed, is known to have significant allele frequency differences from the White River MaSa (see section 2.2). There may also be phenotypic differences between Chiwawa hatchery and White River natural origin brood but comparisons have not yet been made. Chiwawa hatchery and natural origin adults differ in average age, average size, sex ratio, spawning distribution, and fecundity (Hillman et al. 2009).

6.2.4) Reasons for choosing.

Broodstock was selected to prevent extinction of the White River spawning aggregation and to conserve the spatial structure and diversity of spring Chinook major spawning areas within the Wenatchee River.

6.3) Risk aversion measures used to minimize adverse effects to listed fish.

The primary purpose for use of broodstock from the White River is to conserve and rebuild the White River spawning aggregation within its natural boundaries. Risk aversion measures to minimize adverse genetic and ecological effects include:

- Conducting hydraulic egg collection or fry trapping by appropriately trained staff and supervised in the field by a journey level biologist.
- Limiting egg/fry collection to only those redds known to be from naturally produced spawning parents.
    - Assuring that samples are collected randomly and are representative of the White River spawning aggregation.
    - Limiting egg/fry collection from each redd to no more than 135 to assure that the majority of eggs from each redd remain in natural production.
    - Managing the proportion of eggs/fry taken for artificial propagation to reduce the impacts of domestication selection.
    - Uniquely marking broodstock (CWT and PIT-tag) by family to prevent full sibling matings and maximize effective population size.

SECTION 7. ADULT MANAGEMENT

7.1) Objectives.

Adult management strategies are proposed in the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009). This plan is currently being discussed by the HSC and has not been approved yet. Fundamental elements of the proposed management to attain spawning escapement and promote local adaptation relating to abundance and diversity are listed below:

a. Proportionate Natural Influence (PNI): Hatchery fish will be managed at Tumwater Dam according to the sliding scale as shown in the table below. PNI goals are based on the natural origin spring Chinook run size expected. (Percentiles are of run returns observed between 1989 and 2008).

Table 12. Sliding scale for PNI management at Tumwater Dam.

Percentile	NOR Run Size		PNI
	White	Wenatchee River	
>75th	>87	>910	≥ 0.80
50% - 75%	68-86	631-909	≥ 0.67
25% - 50%	41-67	525-630	≥ 0.50
10%-25%	20-40	400-524	≥ 0.40
<10th	<20	<400	Any PNI

b. Minimum spawning escapement: At least 500 effective spawners above Tumwater Dam of which half should be natural origin spawners after an assumed average pre-spawn mortality of 35% (at least 769 adults passed above Tumwater Dam).

c. Abundance Objective: Manage for a maximum run escapement passed at Tumwater Dam of 1,748 and a maximum spawning escapement of 1,569 to achieve sufficient seeding based on current habitat availability. NOR escapement will be unrestricted. The table below shows the interim Wenatchee River Basin spring Chinook escapement targets at Tumwater Dam. All values are for natural and hatchery origin fish are combined. Escapement of natural origin fish will be unrestricted at all run sizes.

Table 13. Maximum spawning and run escapement for the White River and the Wenatchee above Tumwater Dam.

Spawning Area or Mitigation Program	Max. Spawning Escapement Target	Max. Run Escapement at Tumwater Dam [a]
White River	141	217

Escapement Goal Upstream of Tumwater Dam	**1,569**	**1,748**

[a] NOR escapement will be unrestricted. In some years total escapement will be lower that the listed value so that PNI targets can be achieved. As natural origin run sizes increase pHOS will approach 0.00. Maximum run escapement at Tumwater Dam is higher than the spawning escapement to allow for pre-spawn mortality (adjusted up to 35%).

As a result of habitat evaluations, feedback from the M&E program, and due to the evolving nature of the science of salmon recovery, adaptive management will play an important role in guiding the implementation of the program and the management of adult returns in the future. The program is structured to allow adaptive management principles to direct supplementation strategies.

7.2) Disposition of surplus hatchery-origin fish.

Surplus hatchery adults will be managed with a variety of methods. Harvest in ocean and lower Columbia fisheries will remove some hatchery origin fish (see section 3.3). Also, as discussed in the draft Implementation Plan, "removal at Tumwater Dam will be used to prevent over-escapement of HOR. The Chiwawa weir could also be used to remove excess hatchery fish if too many fish (e.g., greater than 1,750) have been passed upstream of Tumwater Dam, or for M&E. Options include:

<u>Reintroductions Into Minor Spawning Areas</u>
Low numbers of excess hatchery adults that arrive at Dryden or Tumwater Dams may be translocated to lower Wenatchee River tributaries to facilitate restoration of spring Chinook use of these Minor Spawning Areas. Excess hatchery fish could be transported to Peshastin Creek, Mission Creek, Chumstick Creek and/or other newly-opened or created habitats to complement on-going habitat restoration activities.

<u>Harvest</u>
Harvest is not expected to be used as a tool to control surplus hatchery-origin White River Chinook salmon for at least 10 years.

<u>Removal at Tumwater Dam</u>
Manual removals of excess hatchery origin fish at Tumwater Dam will be the second priority after minor spawning areas recovery. Fish removed at Tumwater Dam could be distributed to worthy publics or used for nutrient enhancement in tributaries. The need for nutrient enhancement was identified in the Upper Columbia Salmon Recovery Plan (UCSRB 2006) and in the UCTRT Biological Strategy (Appendix H to the Recovery Plan). We [WDFW and YN] suggest that fish of good condition surplused in the first half of the run be distributed for human consumption, while fish in the second half of the run be used for nutrient enrichment."

7.3) Broodstock collection.

7.3.1) Life-history stage to be collected.

The captive brood phase uses eggs or alevins collected from redds produced by naturally spawning adults in the White River. The adult-based supplementation phase will use natural-origin and White River hatchery-origin adults captured that are returning to the White River.

7.3.2) Collection or sampling design.

Include information on the location, time, and method of capture.

See section 5.1 for juvenile-based captive brood collection methods.

Broodstock collection goals for the adult-based supplementation program are proposed in the draft Implementation Plan. They were developed "based on the intended outcome of the release group (conservation or safety net), average fecundity, egg-to-smolt survival, and an assumed equal sex ratio. Initially statistics from the Chiwawa Program (4,785 eggs and 0.8187 egg-to-smolt survival) were applied to all three programs. In future years, if differences are observed for the Nason and White programs, values unique to each major spawning area will be applied to determine broodstock needs.

It is the intent of the co-managers to collect broodstock in a manner that achieves mitigation program needs for each program component and contributes to an increased PNI. We [WDFW and YN] propose to collect natural origin fish for broodstock using an extraction rate of up to 33%. In years when pNOB is 1.0 the actual extraction rate will be lower than 33%. Further, in years of small returns, NOR adults from the Nason and Chiwawa programs may be pooled in a composite broodstock if necessary to meet program goals."

Based on the current fecundity and egg to smolt survival data, a total of 80 adults are required to produce 150,000 smolts. The 10% additional production capacity and assumptions about adult holding mortality would require that the capability of collecting, holding, and spawning of approximately 100 adults be developed.

Broodstock collection methods are also proposed in the draft Implementation Plan: "we propose to manage the Wenatchee spring Chinook population to meet both mitigation and recovery objectives through parental based tagging. In general, all unmarked fish captured at the Priest Rapids Dam off-ladder adult fish trap will be genetically sampled and a PIT tag will be inserted into the dorsal-sinus cavity. Genetic samples will then be sent to the WDFW genetics lab in Olympia, where the samples will be given high priority for processing. Within 10 days, the results from the genetic samples will be available for managers in the Wenatchee basin. Based on the genetic sampling, we will then be able to partition spring Chinook at Tumwater Dam into the spawning aggregates (MaSAs) based on their PIT tags, for either inclusion into broodstock, or for release upstream of Tumwater Dam. Hatchery fish in excess to broodstock and escapement needs will be removed through conservation fisheries and/or at Tumwater Dam."

7.3.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

Juvenile-based Captive Brood:
Currently, all spring-run adult Chinook passing Tumwater Dam are genetically sampled, scale sampled, marks recorded and individually PIT-tagged prior to release. During spawning ground surveys, redds are flagged at time of construction and adult spawners are observed during spawning to classify adults as natural or hatchery origin by observing the presence or absence of the adipose fin and from interrogation of PIT-tags applied at Tumwater Dam. A missing adipose fin denotes a hatchery-origin adult. All hatchery-origin adults with missing adipose fins are presumed to be from other tributaries or river systems because all fish released from the White River program currently are adipose present with a coded wire tag placed at the base of the adipose tissue. Only redds constructed by unmarked adults will be considered for sampling to reduce risk from non-local hatchery adults. An unknown proportion of unmarked adult spawners could be progeny of naturally spawning strays.

Adult-based Supplementation:
Adults will be collected only from their natal streams or, if feasible, at mainstem Wenatchee facilities (Tumwater Dam) if individual adults can be identified by tributary of origin. Stray hatchery fish will be segregated from the broodstock. Plans are to maintain the current marking strategy for fish released from the White River program.

7.4) Proposed number to be collected.

7.4.1) Program goal.

Juvenile-based Captive Brood:
Collect up to 1,500 pre-emergent fry for captive brood rearing based on a maximum sample size of up to 135 fry per redd. The number of fry per redd should be adjusted each year to result in a total collection of 1,200 eggs/fry from natural-origin White River spawners representing up to 50 redds. Redds with known hatchery origin spawners are not sampled.

Adult-based Supplementation:
A total of approximately 80-100 adults of both natural and hatchery origin of White River lineage will be collected for broodstock to meet the smolt production level of 150,000 fish. Ratios of natural to hatchery origin adults will be dependent upon PNI objectives.

7.4.2) Past broodstock collection levels.

(for the last 12 years or for the most recent years available)
Data from WDFW annual reports.

Table 14. Broodstock collection abundance for the White River captive brood program.

Year	Adults Females	Males	Jacks	Eggs (families)	Fry
1997				527 (8)	
1998				199 (4)	
1999				235 (7)	
2000				272 (7)	
2001				na	
2002				183 (3)	
2003				723 (8)	
2004				1,529 (13)	
2005				2,730	
2006					1,487
2007				1,153	
2008				446 (13)	

7.5) Adult transportation and holding.

Facilities and transportation equipment will be designed and constructed to meet the following operating guidelines:

- Haul all adults in 0.5 to 0.6% salt, regardless of duration of haul.
- Haul all adults at loadings no greater than 4.5ft^3 per fish or 34 gallons per fish.
- Haul all adults in 10 ppm MS-222.
- Haul from trap site at least daily but 2x-3x per day or more, as necessary.
- Facilities for adult holding are described in section 5.3 above.

7.6) Broodstock health maintenance and sanitation.

Juvenile-based Captive Brood:

Eyed eggs collected for captive broodstock are bathed in iodophore for 10 minutes immediately after arrival at the incubation facility. See section 9.2.7 for description of fish health management during captive broodstock rearing.

Adult-based Supplementation:

Fish health management for adults following transition to adult-based supplementation is expected to follow guidance provided by Rogers, Brunson, and Evered (2002):

- Remove adults from elevated water temperatures as soon as possible to a pathogen free water source if available.
- Initiate formalin treatments for control of external parasites and/or fungus as listed on label, Investigational New Animal Drug (INAD) permit or through veterinary prescription. Treatments should be no less than three times per week, but may be daily based on recommendation of attending fish pathologist.
- Inject all fish, or at least all females, intraperitoneally with antibiotic within two weeks of collection or at time of first sorting of adults as recommended by the attending fish

pathologist using the following guidelines.

  - If needed, repeat injections shall be administered no less than 20 days and no more than 30 days apart to all females.
  - Inject with not less than 15mg/kg of ERYTHRO-200 or equivalent.
  - Do not inject less than 14 days prior to spawn.
- Do not exceed holding parameters greater than 1gpm/adult and 8ft^3/adult.

Sanitation procedures employed to reduce the transfer and incidence of fish diseases are in accordance with Washington Co-Manager Fish Health Policy (1998), PNFHPC (1989), and IHOT (1993) guidelines.

7.7) Disposition of carcasses.

Carcasses resulting from the adult-based supplementation phase of the project will follow standard disposition protocols which may include distribution into the stream of origin for nutrient enhancement.

7.8) Risk aversion measures used to minimize adverse effects to listed fish.

Risk aversion measures include (see details above):

- Collect known White River origin broodstock.
- Follow developed spawning ground and hatchery broodstock composition guidelines.
- Use broodstock collection procedures that minimize impacts to listed fish.
- Follow adult transportation, holding, and fish health maintenance guidelines.

SECTION 8. MATING

8.1) Selection method.

Juvenile-based Captive Brood:

Mature captive broodstock are the surviving representatives of families collected as eyed eggs or fry from redd pumping three to five years previously (see sections 2.2, 5.1, and 7.3). It is intended that all maturing captive broodstock will be used for spawning. Mature fish are spawned systematically as they become ripe, usually during one spawning session per week. Each individual fish is identified by a PIT-tag and coded-wire tag denoting the specific family (redd) from which that fish was originally extracted. Each fish is spawned after ascertaining family and brood year by interrogation of the family-specific tag. The highest priority is to mate males and females from different brood years and, secondarily, from different families within brood years to assure the highest effective population size possible. Factorial matings (i.e., minimum 2 x 2) are used to further increase the genetic diversity within a given brood year. When surplus males are generated, such as early maturation of two-year-old precocial males, representative milt samples may be saved through cryopreservation. Infrequently, an adult female may mature and ripen when a mate is not available. Use of non-sibling cryopreserved males would be used to fertilize these eggs. If this is not possible, biological data will be recorded and the individual will be sacrificed without spawning.

Adult-based Supplementation:

Broodstock will be collected randomly within a collection period but the number collected during any period will be proportional to the numerical abundance of the run at large at that point in time.

8.2) Males.

Juvenile-based Captive Brood:

It is intended that all males maturing during the spawning season will be used for fertilization. However, efforts are made to ensure equal contribution from each family. Males of differing age classes, including precocious males are routinely used in the ratio they occur during captive brood spawning. Program spawning protocols strive to achieve a 1:1 ratio of males and females, combined in 2x2, 3x3, or similar matrices to capture and maintain a substantial proportion of available genetic material. When large numbers of males mature at two yrs of age, representative samples of milt will be cryopreserved; allowing the option for inclusion in subsequent spawning cycles and assuring availability of milt if an adequate number of live males are not available for spawning. Because the viability of cryopreserved sperm is generally low and highly unreliable, preference is given to using live males to achieve spawning objectives. Repeat spawners may be used when necessary if there is a shortage of males from appropriate families and age groups to meet mating protocols.

Adult-based Supplementation:

Specific spawning protocols for adult-based supplementation may be developed that are similar to those currently in use for other spring Chinook recovery and mitigation programs. They include 1:1 male to female ratios, individual matings, factorial matings using backup males, and inclusion of all age classes in the ratio they occur in the natural-origin population.

8.3) Fertilization.

Juvenile-based Captive Brood:

See section 8.2 for the spawning protocol.

The fertilized eggs from each individual cell within a factorial mating are held separately within incubators. Two elements are of importance. First, discrete matings (cells of a factorial design) can be monitored and evaluated to attribute sources (male or female) of high or low mortality rates through analysis of variance. Secondly, individual groups can be separated based on fish health status, especially BKD or viral status, following fish health screening.

Adult-based Supplementation:

See section 8.2. Specific spawning protocols for adult-based supplementation may be developed that are similar to those currently in use for other spring Chinook salmon recovery and mitigation programs. They include 1:1 male to female ratios, individual matings, factorial matings using backup males, and inclusion of all age classes in the ratio they occur in the natural-origin population.

8.4) Cryopreserved gametes.

Milt has been preserved from a total of 27 males from the 2003 and 2004 brood years. Preserved milt has been used for White River spawning. Viability at AquaSeed was reported to be approximately 30% (Greg Hudson, personal communication, 2005).

8.5) Risk aversion measures used to minimize adverse effects to listed fish.

The greatest risk during spawning of captive broodstock is the loss of within-population genetic variance. Spawning protocols are in place specifically to minimize this risk.

The captive brood spawning protocol requires that individual spawners be identified to family by interrogating coded-wire tags or PIT-tags with codes unique to individual families. Tags are interrogated at time of spawning to allow design of factorial mating solutions and to assure that no full-sib matings occur. The priority is to produce matings across brood years (age classes) and across families within brood years. Milt from each male is checked for motility prior to use in matings.

The factorial mating scheme will be used to capture the maximum possible genetic variation. In rare cases single males or females may be mated to maximize numerical abundance and to assure that all genetic material is captured for ensuing generations.

Specific spawning protocols for adult-based supplementation will be developed as the program converts away from juvenile-based captive brood. As with captive broodstock, the greatest source of genetic risk is loss of within-population genetic variation. Current protocols in use for other spring Chinook recovery and mitigation programs to conserve genetic variation include 1:1 male to female ratios, individual matings, factorial matings using backup males, and inclusion of all age classes in the ratio they occur.

SECTION 9. INCUBATION AND REARING

9.1) Incubation.

9.1.1) Number of eggs taken and survival rates.

Provide survival to eye up and/or ponding data for the most recent twelve years or for years dependable data are available.

Juvenile-based Captive Brood:
See section 7.4.2, Past Collection Levels, for captive brood egg take numbers. See section 9.2.1 for data on egg survival rates.

Second generation F2 progeny:
The 2007 brood egg take was 229,302 and the survival rate from green to eyed egg was 80.2% (Tonseth and Maitland 2008). See section 9.2.1 for more data on egg survival rates.

9.1.2) Disposition of surplus eggs.

Program goals are designed to avoid surplus eggs by estimating the required number of females required for the program. In the event surplus eggs exist, the PRCC HSC will make a decision as to the best use of the surplus eggs. Possible actions include placement of egg incubation boxes in the White River, hatching eggs, and direct planting of unfed fry, fed fry, fingerlings, pre-smolts or smolts into the White River. During 2007, approximately 139,000 surplus fingerlings were directly released into the White River.

9.1.3) Loading densities.

Each tray of a vertical incubator is populated with eggs from one female. Density per tray has ranged from 183 to 1,529 eggs collected from one or more natural redds. Average tray loadings for F2 progeny of captive broodstock has ranged up to approximately 1,600 eggs over three years. Vertical style incubators are arranged in half stacks (eight trays) and receive 5 gpm of water flow each, or in full stacks.

9.1.4) Incubation conditions.

The Little White Salmon NFH water flow system is monitored by alarm. Dissolved oxygen is tested periodically, usually when water flow has been adjusted. Dissolved oxygen is at saturation when water enters the incubators. Dissolved oxygen levels have decreased no more than 0.5 ppm at any check.

9.1.5) Ponding.

Swim-up fry are placed in 104 cubic foot rectangular fiberglass nursery tanks located in the hatchery building at Little White Salmon NFH. Fish are fed during this time with automatic feeders. Once sufficiently on feed, larger groupings are made based on ELISA optical densities. Nursery tanks with fish of similar BKD titer levels are combined and transferred to the 8’ x 80’ lower raceways for further early rearing prior to eventual transfer to the upper raceways for final rearing.

9.1.6) Fish health.

Juvenile-based Captive Brood:
Eggs in vertical incubators are treated periodically with formalin to control fungus. Splash barriers are placed between incubation stacks. Vertical incubator trays are generally left undisturbed. Any mortality is removed by picking individual eggs at the eyed stage after shocking.

During the spawning process, organ tissue from each female is sampled by a fish health expert to screen for pathogens, especially BKD. Ovarian fluid is also sampled and submitted to USFWS or WDFW fish health laboratories for viral screening. Once fertilized, all eggs are water hardened in an iodophore solution to minimize transfer of disease organisms.

Additionally, sanitation procedures employed to reduce the transfer and incidence of fish diseases are in accordance with Washington Co-Manager Fish Health Policy (WDFW 1996), PNFHPC (1989), and IHOT (1993) guidelines.

9.1.7) Risk aversion measures used to minimize adverse effects to listed fish.

Eggs are currently incubated in pathogen-free well water at all times. Eggs are left undisturbed to maximize survival. Fungus is controlled with periodic formalin treatment. Water source has been equipped with alarms and power supply is protected by back-up generators. Future incubation systems will be similar.

9.2) Rearing.

9.2.1) Survival rates.

Juvenile-based Captive Brood:
See Section 9.1.1
Broodstock:
Survival from eyed egg to maturity has averaged 37.2% and ranged from 4% to 72.0% for the five brood years for which complete data are available. Increases in survival of more recent brood years suggest the survival goal may be met or exceeded.

Table 15. Survival rates of White River captive broodstock.

Summary of survival rates of White River captive broodstock from eyed eggs to maturity (M. Tonseth, WDFW, pers. com.).		
Brood Year	Number of Eyed Eggs or Fry Shipped to AquaSeed	Survival of eyed eggs fry to Spawn (%)[1]
1997	527	4.0
1998	182	25.0
2000	272	31.7
2002	171	72.0
2003	699	53.1
2004	1,432	
2005	2,742	
2006[2]	1,487	
2007	1,153	
Mean	*962*	*37.2*

[1] Eyed egg to maturity survival goal of 30%

[2] 2006 brood were captured as fry in 2007

<u>Second generation F2 progeny</u>:
Recent increases in second generation survival (2004 and 2005 brood) suggest the green egg to release goal of 65% may be met or exceeded in the future.

Table 16. Survival rates (%) for various life stages of second-generation (F_2) White River juveniles from spawning of captive broodstock 2002 – 2005 broods.

Survival rates (%) for various life stages of second-generation (F_2) White River juveniles from spawning of captive broodstock 2002 – 2005 broods (from Tonseth and Maitland, 2008)							
Life Stage	BY 2002[a]	BY 2003[a]	BY 2004	BY 2005[b]	BY 2005[c]	Mean	Proposed survival standard
Fertilize to eyed egg	0.780	0.370	0.818	0.821	0.821	0.697	0.800
Eyed egg to ponding	0.852	0.940	0.981	0.890	0.890	0.916	0.980
30 days post ponding	0.996	0.994	0.997	0.996	0.996	0.996	0.970
100 days post ponding	0.981	0.961	0.989	0.986	0.988	0.981	0.930
Ponding to release	0.565	0.723	0.954	0.975	0.563	0.756	0.830
Transport to release	0.979[d]	0.969[d]	0.977[e]	0.992	0.572	0.898	0.950
Fertilization to release	0.376	0.252	0.765	0.712	0.411	0.503	0.650

a Does not include F2 juveniles retained for broodstock.

b Progeny reared at Little White Salmon NFH and released from the Lake Wenatchee Net Pens.

c Progeny reared at Aquaseed and released from the Lake Wenatchee Net Pens.

d Transported from Aquaseed to acclimation sites on the White River.
e Transported from Aquaseed to Eastbank FH and then released directly into the White River

9.2.2) Rearing criteria.

Density and loading indices used for design and development of rearing and acclimation facilities will include:

Table 17. Rearing and acclimation criteria for the White River hatchery program.

REARING CRITERIA		
Volume Density	lbs/ft^3 (15fpp)	lbs/ft^3/inch (VI)
Hatchery Rearing, Low BKD	0.7	0.125
Hatchery Rearing, High BKD	0.3	0.060
Acclimation		
Flow Density	lbs/gpm (15fpp)	lbs/gpm/inch (FI)
Hatchery Rearing, Low BKD	4.0	0.75
Hatchery Rearing, High BKD	3.2	0.60
Acclimation, Low BKD	4.0	0.75
Acclimation, High BKD	3.2	0.60

Little White Salmon NFH volume (VI) and flow (FI) indexes are within these guidelines. For example, brood year 2007 F2 fish on September 30, 2008 were held with a DI of .06 and a FI of .34 (Doulos et al. 2008).

9.2.3) Fish rearing conditions.

Hatchery Rearing:
At the Little White Salmon NFH facilities, as fry reach button up, they are ponded into nursery tanks. Captive brood fish are reared until they reach a size sufficient to safely PIT-tag and sample for genetic analysis. The tagging scheme is necessary to differentiate families to develop mating strategies during spawning and to allow tracking of individual fish for growth and mortality assessment. In addition, a coded-wire tag denoting a specific family is placed in the adipose fin to provide redundancy if the PIT-tag is lost.

After tagging, broodstock fish are redistributed to super raceways (10'x110') with flows of 600 gpm and reared for up to five years until mature. Feeding schedules are adjusted during the rearing season according to fish size, anticipated growth rates and feed conversions. Mortality is removed daily and each fish is recorded by family of origin and cause of death. Fish health monitoring is performed by USFWS fish health specialists under contract to Grant PUD.

Captive brood fish are held in the concrete raceways until maturity. Approximately 2 months before spawning, the older brood years are checked for maturation using ultrasound. Maturing fish are then transferred to the lower raceways for final holding and spawning. These 8' x 80' raceways have an elastomeric coating on the raceway floor and walls, and are enclosed by a secure metal building.
F2 and adult-based supplementation fish will also be reared in the 10' x 110' concrete raceways at Little White Salmon Hatchery.

Acclimation:
Best Management Practices will be used to maintain an optimal rearing environment (i.e., maintaining appropriate water flow, water temperature, dissolved oxygen, flow index, density index, and facility cleanliness; and minimize handling and other stressors) to support the production of healthy, high-quality smolts.

9.2.4) Growth information.

Captive broodstock are not routinely sampled for length and weight to avoid additional stress that may cause elevated mortality due to BKD. Size data is estimated from mortalities. The following weight estimates for 2003 - 2004 brood captive broodstock are derived from monthly tank utilization records and are indicative of growth rates for captive broodstock through two years of rearing. Growth estimates for broodstock at the Little White Salmon NFH will be updated when information becomes available. Measurements will be conducted in conjunction with handling events for other purposes to avoid additional stress.

Table 18. Estimated growth of the 2002 White River captive broodstock derived from mortality that occurred during rearing.

Estimated growth of the 2002 White River captive broodstock derived from mortality that occurred during rearing.					
Month	Weight (g)	% Gain[1]	Month	Weight (g)	% Gain
January '03	0.39		January '04	45.0	50.0
February	0.91	33.3	February	64.0	42.2
March	1.7	86.8	March		
April	3.0	76.4	April	98.0	53.31
May	4.5	50.0	May	144.0	46.9
June	6.7	48.9	June	181.0	25.7
July	9.2	37.3	July	222.0	22.7
August	15.0	63.0	August	260.0	17.1
September	17.0	13.3	September	298.0	14.6
October			October	345.0	15.8
November			November		
December	30.0	76.51	December	579.0	67.81
[1] Gain over two or more months					

9.2.5) Feed details.

Include food type used, daily application schedule, feeding rate range.

Feed is procured from various suppliers depending on recommendations of fish health specialists and availability. In 2009, at the Little White Salmon Hatchery, both F1 and F2 generation juveniles were fed the Skretting BioVita diet, starter #0 through 2.5 mm sized pellets. Feeding occurs once per hour during the initial feeding period and decreases to 3 times per day following the second year. Juvenile feeding rates are calculated as a percentage of body weight based on water temperature using manufacturer feeding charts. Supplemental feeding can occur by eye especially during times of medicated feed treatment when feed palatability can be a problem. F1 generation captive brood are transitioned to the Skretting BioBrood LE diet, feed sizes 4 - 6 mm, and are fed by eye.

9.2.6) Fish health.

Juvenile-based Captive Brood:

Fish Health Monitoring: Fish health monitoring is performed by USFWS fish health specialists under contract to Grant PUD. During routine visits fish health examinations are performed and cause of death determined on mortalities collected since the last visit and on moribund fish from the rearing tanks.

Disease Treatments: Typical treatments are as follows:

- Formalin – prophylactic fungal treatment and post-handling.
- Aquamycin – fed for BKD treatment and prophylaxis.
- Erythromycin – fed and injected to manage BKD.
- Azithromycin – fed and injected to manage BKD.
- Chloramine T – bath to treat external bacteria.
- In addition, fish health specialists are present during spawning at which time they take pathogen and viral screening samples.

Sanitation Procedures: As recommended by IHOT (1995) facilities will implement the following sanitation procedures:

1) Disinfect/water - harden eggs in buffered iodophor disinfectant. Eggs will be disinfected prior to entering "clean" areas in incubation room.
2) Place foot baths containing disinfectant at the incubation facility's entrance and exit.
3) Sanitize equipment and rain gear utilized in broodstock handling or spawning after leaving adult area and before using in other rearing vessels or the hatchery building.
4) Sanitize equipment used to collect dead fish before use in another pond and/or fish lot.
5) Disinfect equipment, including vehicles used to transfer eggs or fish between facilities, before use with any other fish lot or at any other location. Disinfecting and disinfected water will be disposed in designated areas and not in streams.
6) Sanitize rearing vessels after removing fish and before introducing a new fish lot or stock either by using a disinfectant or by leaving dry for an extended time.
7) Properly dispose dead fish and prevent fish that die of disease to enter natural waters.
8) Potential cross contamination is minimized by maintaining each rearing vessel as a separate unit. Equipment used is disinfected between use in different rearing units.

Adult-based Supplementation:

Fish health will be managed consistent with WDFW Fish Health Manual (1996), Co-Managers Fish Disease Control Policy (1997), and Pacific Northwest Fish Health Protection Committee (1989).

9.2.7) Smolt development indices.

No biochemical smolt development indices have been used to date. Use of lethal or high stress indicators is not preferred for this ESA-listed aggregate. Indicators of smoltification such as coefficient of variation in length and condition factor may be used as production levels increase. Length and weight data were taken at release in 2004, 2005 and 2006. Condition factors were subsequently calculated but were not used as predictors of smolt preparedness.

9.2.8) "Natural" rearing methods.

“Natural” type rearing has not been incorporated into the captive broodstock program at this time. Facilities constructed in the future will use natural rearing conditions as described in sections 5.5 and 5.6. Important natural conditions are a water temperature profile that can help produce smolts that survive at high rates and a low density rearing environment.

9.2.9) Risk aversion measures used to minimize adverse effects.

Risk aversion measures that may be employed include:

- Water supply, facility, and fish health risk aversion measures described previously will be employed.
- Lots will be segregated according to the BKD status of the parents.
- Survival will be maximized to the extent possible through the use of natural rearing conditions and rearing criteria to improve numerical abundance and retain maximum available genetic variation.

SECTION 10. RELEASE

10.1) Table 19. Proposed fish release levels and sizes.

Age Class	Maximum Number	Size (ffp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	Up to 200,000[1] (years 2007 – 12)	80 - 30	Variable	White River
Yearling	150,000	15	April-May	White River or Lake Wenatchee

[1]Fingerling spring Chinook above interim yearling program needs available for planting in the White River through 2012.

The planned release size is 30 grams [15 fish/lb (ffp)]. This is larger than UCR spring Chinook smolts which migrate at 5 to 17 grams. Natural origin Chiwawa yearlings captured in downstream migrant traps average (for the period 1996-2007) 9.4 grams (Hillman et al. 2009), for example. The bigger size has been adopted because larger smolts survive to adulthood at higher rates (Bilton 1984) and may spend less time moving through the freshwater system.

Recent research indicates that spring growth rates are also important to adult survival. Beckman et al. (1999) state: "Maintaining fish at a relatively small size initially, then inducing rapid growth in the final spring, may result in high-quality smolts…" Fast spring growth may allow smaller smolts to survive at high rates.

Studies at the Cle Elum Supplementation and Research Facility have shown that 37-49% of hatchery reared males may undergo precocious maturation (Larsen et al. 2004) when reared using standard hatchery practices, which include releasing large smolts. Experiments now being done are showing that small smolts produced with a growth profile that includes relatively slow fall growth and fast spring growth will reduce the number of precocious males in the population and increase the average weight of returning adults. Production scale tests have shown that fish raised with more natural growth profile and to a smaller ultimate size have lower adult return rates and lower precocious maturation levels (Brian Beckman and Don Larsen, NOAA Science Center, personal communication).

This research will be followed and may help determine future smolt release sizes for this program. For the present, due to the importance of increasing population sizes quickly, the program will adopt the strategy of using fast spring growth rates to produce large smolts.

10.2) Location(s) of proposed release(s).

Release point: White River, Wenatchee River (WRIA 45)
Basin or Region: Upper Columbia River

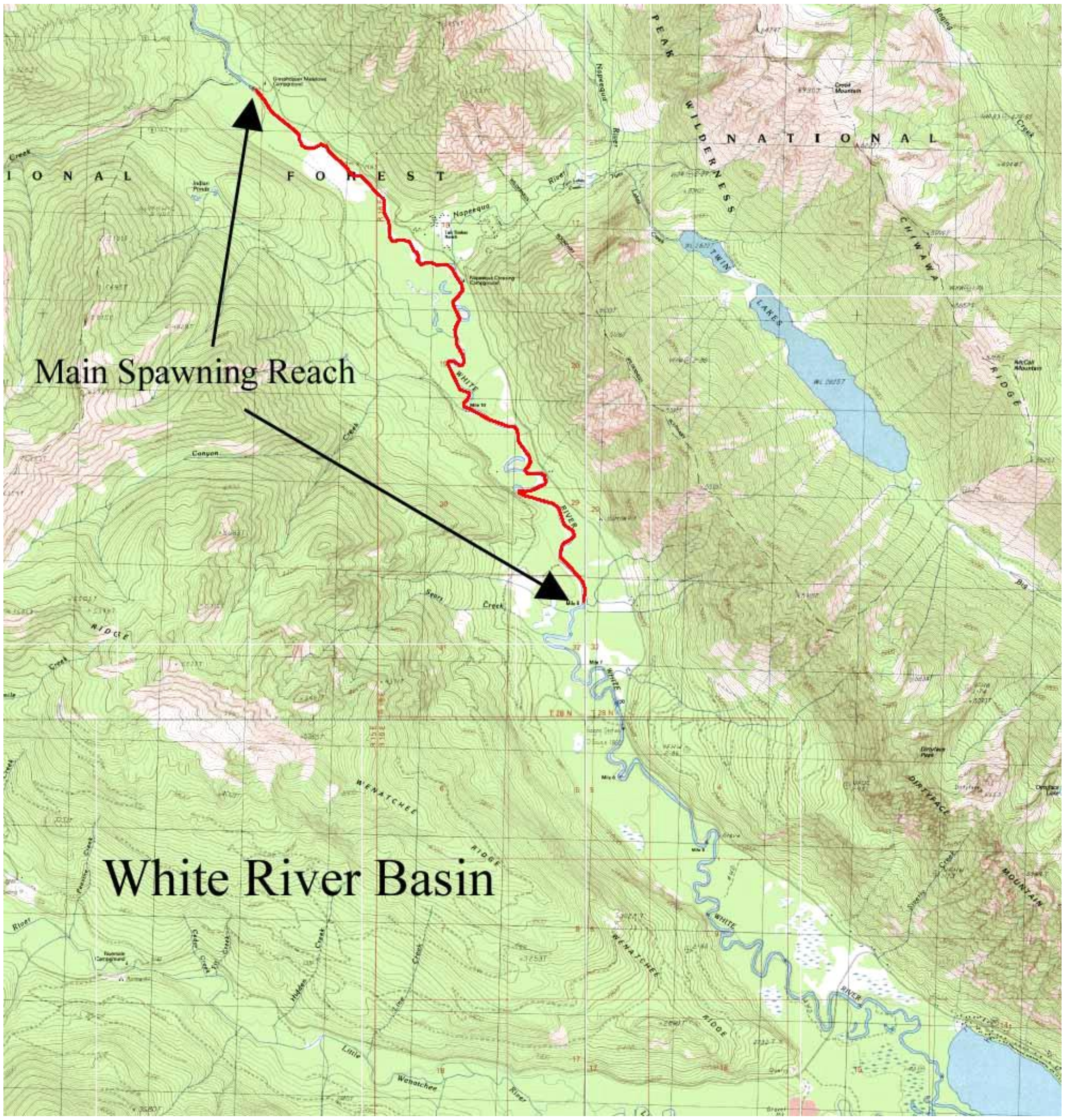

Figure 6. Main spawning reach of the White River population.

Release locations have not yet been finalized and may include net pens in Lake Wenatchee, an acclimation site near the mouth of the White River, and sites in the main spawning reach. Preliminary data suggests that survival in Lake Wenatchee may be low, so it is also possible that fish may be released at the exit of the Lake after acclimation to White River water.

10.3) Table 20. Numbers and sizes of fish released.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
2004							2,589	8 ffp
2005							1,946	8.4 ffp
2006							1,654	3.6 ffp
2007[1]					139,644	208.7 ffp	69,102	12.6 ffp
2008							142,033	17.7 ffp
Average								*10.1 ffp*

Data source: Murdoch and Hopley 2005; Tonseth and Maitland 2008, Eastbank Hatchery.
[1]Fingerline releases of BY 2006 fingerlings were made in 2007 due to excess numbers of BY fish from that brood year. The remainder were released as smolts in 2008.

Release sizes were larger than the 15 ffp goal due to the relatively warm rearing water temperatures at AquaSeed. Temperature and rearing conditions at the Little White Salmon NFH allow release size goals to be met. If an over-winter acclimation facility is developed, it may be difficult to achieve release size goals because of reduced growth capacity during winter months with very low water temperatures. If the captive broodstock results in too many eggs, then these may be released into the White River as fry and that this is not likely to result in much competition with naturally rearing spring Chinook salmon because of the low numbers of redds and that there is likely underutilized habitat in the White River.

10.4) Release protocols.

Second generation progeny of captive broodstock have been released into the White River since 2004. For 2004 and 2005, temporary acclimation tanks were installed by Grant PUD at Tall Timbers Ranch located at river kilometer 18.5. Pre-smolts from 2002 brood spawning were transported to the acclimation facilities on 5 April 2004. They were force released on 22 April 2004 after receiving 17 days of acclimation. Pre-smolts from the 2003 brood spawning were transported to the acclimation site on 16 March 2005. They were force released on 2 May 2005 after 47 days of acclimation. In each case, individual weight samples were taken as fish were being released. On April 5, 2006, smolts at 3.6 ffp were released at a selected log jam site.

Interim acclimation is anticipated to include net pens or natural features. In general, yearlings will be transferred to the acclimation sites as soon as possible (mid to late March). Fish will be released in late April or early May by removing the nets to allow volitional release. Fish that do not leave the acclimation ponds volitionally will be forced out with seine nets in mid-May. Individual length and weights will be measured as fish are being released.

10.5) Fish transportation procedures.

Pre-smolts will be hauled by truck from rearing and overwinter acclimation sites to the final release locations. Hauling criteria include (IHOT 1995):

- Haul tank interiors and exteriors, when transporting between watersheds, will be disinfected prior to use.
- Increase O2 levels to 15 ppm prior to loading.
- Maintain temperatures at 42-48^{0}F.
- Haul at densities of less than 1.25 lbs/gallon.
- Prior to release, temper haul water with receiving water to keep the difference below 10^{0}F. The maximum rate of temperature change will be 2^{0}F/hr.

10.6) Acclimation procedures.

See section 10.4 for fish acclimated on site at the White River. Fish that were not held in temporary rearing tanks on site (Tall Timbers Ranch) in 2006 were released from the planting tanker truck to the river after tempering the water. Current protocol for tempering is to slowly pump natal water into the transport tanker truck. This is done at a rate that will not exceed tempering of more than 2ºF per hour until the temperature of the natal stream has been reached. Entire displacement of the tanker truck water will be dependent on the water flow needed to remain within the rate indicated. Dissolved oxygen levels within the tanker truck are monitored to remain between 7.0 – 12.0 ppm while internal pumps aerate and re-circulated water within the tanker truck during this process.

After acclimation sites are constructed, current plans call for fish to be reared at hatchery sites until November and then be transported to acclimation sites. Acclimation may occur in constructed rearing ponds and/or in existing side channels. A density index of less than 0.06 lb/ft^3/inch will be maintained at the sites. Surface water will be used for acclimation. Dissolved oxygen levels are expected to be greater than 7 ppm at the discharge of the ponds and a flow index of less than 0.75 lb/gpm/inch, depending on water temperature, will be used. Personnel will feed fish and will maintain a presence on location to help reduce predation. Volitional migration out of the upstream locations will be allowed in concert with the spring freshet and increasing discharge in the mainstem Columbia River.

10.7) Marks applied to identify hatchery adults.

All fish produced in the hatchery will be marked or tagged prior to release. Two small groups of White River smolts (2002 and 2004 brood) have been released (see sections 10.3 and 10.4) without artificial marks. This strategy was used because other hatchery groups that might be encountered would have had a similar and conflicting external tag or mark. In this situation, the absence of a mark is in itself considered equivalent to an identifiable mark, but does not allow for immediate recognition during broodstock collection. To allow for positive identification as White River hatchery fish without sacrifice, all hatchery yearlings will be adipose present with a coded-wire-tag in the base of the adipose tissue. Excess brood YR 2006 fish that were released as subyearlings, were adipose present with a half CWT in the snout. PIT-tags or other types of tags may be used to provide pre-season run-escapement for broodstock and adult management strategies, gather additional M&E or study information. Any changes to the current marking protocol will be coordinated with the PRCC HSC and regional hatcheries to avoid conflicting marks.

Table 21. Tag type and number for White River captive brood fish by brood-year.

Brood year	Release strategy	Release number	Tag type and number applied
2002	Acclimation tanks in WR	2589	100% adipose present, 100% adipose CWT
2003	Acclimation tanks in WR	2096	100% adipose present, 100% adipose CWT
2004	Acclimation tanks in WR	1639	100% adipose present, 100% adipose CWT
2005	Net pens	63779	100% adipose present, 100% adipose CWT
	Direct to WR-subyearling	139644	100% adipose present, 100% snout CWT
2006	Direct to WR-yearling	142033	100% adipose present, 100% adipose CWT, and 30,928 PIT-tags
	Net pens	87671	100% adipose present, 100% adipose CWT, and 39,820 PIT-tags
2007	Direct to Lake Wenatchee	44172	100% adipose present, 100% adipose CWT

10.8) Disposition plans for surplus fish.

See also section 10.1. Captive brood phase surplus White River juveniles could be available for release in the basin between 2007 and 2012. Any fish in excess of program rearing goals would be either direct planted into their natal stream or receive limited acclimation on White River water per PRCC HSC review. All hatchery fish released must be marked or tagged in order determine origin using non-lethal methods as returning adults. The number to be differentially marked from this group for evaluation purposes would be determined by the PRCC HSC.

During the adult-based supplementation phase, fish produced in excess of the 150,000 target number will be reared to a sufficient size for tagging or marking and then released into the White River. If the captive broodstock results in too many eggs, then these may be released into the White River as fry and that this is not likely to result in much competition with naturally rearing spring Chinook salmon because of the low numbers of redds and that there is likely underutilized habitat in the White River. The program will be managed to minimize excess fish.

10.9) Fish health certification procedures.

Two weeks prior to release, a fish health specialist will document smolt health through such indices as condition factor, fin condition, descaling and, if necessary, autopsy-based analysis such as organosomatic indexing. Epizootics may trigger review and recommendations by the JFP before release.

10.10) Emergency release procedures.

To protect acclimation sites from water system failure, three levels of redundancy will be used. Supplemental oxygen was plumbed to release oxygen into rearing tanks if low flow is detected via the flow alarm system. Standby generators will be available to produce power in the event of electrical supply loss. Nearby staff will be available to respond to interruptions of power and flow in order to restore flow and release fish if necessary.

Depending on the type of temporary sites being considered, emergency on-site release procedures will be developed by the HSC which could involve direct release to the White River if no other options are available.

Depending on site characteristics and risks for flooding, acclimation rearing units may be designed to survive flooding but will not be designed to prevent fish escape. Fish may be allowed to volitionally migrate during flood events.

10.11) Risk aversion measures used to minimize adverse effects to listed fish.

The risk of ecological hazards to listed species resulting from liberations of hatchery-origin spring Chinook will be minimized through the following measures:

- Hatchery spring Chinook will be reared to sufficient size such that smoltification occurs within nearly the entire population, reducing residence time in the streams after release and promoting rapid seaward migration. Degree of smoltification may be assessed through measurement of coefficient of variation for fork length or average condition factor to avoid fish stress and mortality.
- Spring Chinook smolt releases will be timed with water budget releases from upstream dams to further accelerate seaward migration, to improve survival at mainstem dams, and to reduce the duration of interactions with wild fish.
- Acclimation in natal stream water will contribute to smoltification, reducing the residence time in the rivers and mainstem corridors.
- Release locations may be in upstream areas in the future to improve imprinting and reduce straying to other watersheds.
- The long-term goal is to acclimate fish through the winter in natal stream water to further reduce straying.
- Hatchery spring Chinook smolts will be released when environmental conditions exist that promote rapid emigration (i.e., new moon phase, increasing water temperature and increase river discharge).
- Adult contribution to natural spawning will be calibrated to be within the tributary carrying capacity when historical productivity has been restored.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

An M&E plan that describes Grant PUDs activities for all of its hatchery programs can be found in Pearsons and Langshaw (2009). Some of this plan is abstracted below.

11.1) Monitoring and evaluation of "Performance Indicators".

Monitoring and evaluation will play an important role in helping measure program results and determining future direction. The initial five-year M&E Plan proposed for the program identifies nine objectives, listed below. These plan objectives and subsequent hypotheses were generated from Chelan and Douglas PUDs' M&E plan (see Habitat Conservation Plans Hatchery Committee 2006 and Chelan PUD Habitat Conservation Plan's Hatchery Committee 2005), the BAMP, and the HCP and PRCC hatchery subcommittees. They were developed to assess progress toward reaching the hatchery program goals defined by the JFPs.

The HCP M&E plan documents describe the data to be collected to test the hypotheses for each objective. The UCR White River Spring Chinook Supplementation Program has and will continue to use these documents as the basis for implementing a data collection plan. A number of adult and juvenile-based variables will be measured for both hatchery and naturally produced fish. Methods used during data collection will likely include: spawning ground surveys, broodstock sampling, hatchery juvenile sampling, smolt trapping, precocity sampling, PIT tagging, CWT tagging, radio tagging, genetic sampling, disease sampling, and snorkel surveys.

A monitoring principle included in the HCP M&E plan is use of reference streams for comparative analysis. Availability, feasibility, and viability of using reference streams are currently being evaluated. Due to concerns about finding suitable streams and the ability to detect impacts, it has not yet been decided whether this method will be used. Until the comparison technique is determined, the term "reference condition" will be substituted for "reference stream" in the M&E plan as adopted by the program.

Objective 1: Determine if supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a reference condition and if the change in the natural replacement rate (NRR) of the supplemented condition is similar to that of the reference condition.
Hypotheses:
Ho: The annual number of hatchery produced fish that spawn naturally is less than or equal to the number of naturally and hatchery produced fish taken for broodstock.
Ho: The annual change in the number of naturally spawning fish is less than or equal to the annual change observed in the reference condition.
Ho: The annual change in the number of naturally produced adults is less than or equal to the annual change observed in the reference condition.
Ho: The annual change in the NRR is less than or equal to the annual change observed in

the reference condition.

Objective 2: Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.
Hypotheses:
Ho: Migration timing Hatchery = Migration timing Naturally produced
Ho: Spawn timing Hatchery = Spawn timing Naturally produced
Ho: Redd distribution Hatchery = Redd distribution Naturally produced

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.
Hypotheses:
Ho: Allele frequency Hatchery = Allele frequency Naturally produced = Allele frequency Donor pop
Ho: Genetic distance between subpopulations Year x = Genetic distance between subpopulations Year y
Ho: Δ Spawning Population = Δ Effective Spawning Population
Ho: Age at Maturity Hatchery = Age at Maturity Naturally produced
Ho: Size at Maturity Hatchery = Size at Maturity Naturally produced

Objective 4: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate) is greater than the natural adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific HRR expected value based on survival rates listed in the BAMP (1998).
Hypotheses
Ho: HRR Year x $\leq$ NRR Year x
Ho: HRR $\leq$ Expected value per assumptions in BAMP

Objective 5: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.
Hypotheses:
Ho: Stray rate Hatchery fish > 5% of total brood return
Ho: Stray hatchery fish > 5% of spawning escapement of other independent populations[1]
Ho: Stray hatchery fish > 10% of spawning escapement of any non-target streams within independent population[1]

Objective 6: Determine if hatchery fish were released at the programmed size and

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[1] This stray rate is suggested based on a literature review and recommendations by the ICBTRT. It can be re-evaluated as more information on naturally-produced Upper Columbia salmonids becomes available. This will be evaluated on a species and program-specific basis and decisions made by the PRCC HSC. It is important to understand the actual spawner composition of the population to determine the potential effect of straying.

number.
Hypotheses:
Ho: Hatchery fish Size = Programmed Size
Ho: Hatchery fish Number = Programmed Number

Objective 7: Determine if the proportion of hatchery fish on the spawning grounds affects freshwater productivity (i.e., number of smolts per redd) of the supplemented condition when compared to the reference condition.
Hypotheses:
Ho: juveniles/redd of the supplemented condition ≤ juveniles/redd of the reference condition
Ho: The relationship between proportion of HOS and juveniles/redd is ≤ 1.
Ho: Slope of Line (juveniles/redd vs. redds) of the supplemented condition ≤ Slope of Line (juveniles/redd vs. redds) of the reference condition.

Regional Objectives
Two additional objectives are not explicit in the goals as specified above, but are included within the total framework of this plan because they are related to the goals and are concerns related to not only Grant PUD's programs but also other artificial propagation programs in the region. These regional objectives will be implemented at various levels into all M&E Plans in the upper Columbia River (Chelan PUD, Douglas PUD, Grant PUD, USFWS, and CCT). Currently, a BKD management plan is being produced as an example of a coordinated effort to address a prevalent disease issue. These objectives may be more suitable for a specific hatchery or sub basin, the results of which could be transferred to other locations. As such, the PRCC HSC should ensure that these efforts are coordinated throughout the region so resources (e.g., fish, facilities, and cost) are used efficiently. Other objectives that are deemed more regional in nature, per the PRCC HSC, could also be included in the section.

Objective 8: Determine if the incidence of disease has increased in the natural and hatchery populations.
Hypotheses:
Ho: Conc. BKD supplemented fish Time x = Conc. BKD supplemented fish Time y
Ho: Conc. BKD hatchery effluent Time x = Conc. BKD hatchery effluent Time y
Ho: Conc. BKD supplemented stream Upstream Time x = Conc. BKD hatchery effluent Time x = Conc. BKD supplemented stream Downstream Time x
Ho: Hatchery disease Year x = Hatchery disease Year y

Objective 9: Determine if the release of hatchery fish impact non-target taxa of concern (NTTOC) within acceptable limits.
Hypotheses:
Ho: NTTOC abundance Year x through y = NTTOC abundance Year y through z
Ho: NTTOC distribution Year x through y = NTTOC distribution Year y through z
Ho: NTTOC size Year x through y = NTTOC size Year y through z

There are two additional central uncertainties associated with the implementation of Parental Based Trapping proposed in the draft Wenatchee Basin Spring Chinook Management Implementation Plan (YN and WDFW 2009):

Objective 10: Will implementing a hatchery program so that a running mean PNI goal of 0.67 or greater is achieved, increase the long-term fitness of the population it is intended to supplement
Hypothesis:
Ho: If a PNI of 0.67 or greater is achieved, the productivity of the population will increase.
Ho: If a PNI of 0.67 or greater is achieved, the fitness of the population will increase.

Objective 11: Does handling at Tumwater Dam and/or Off-ladder Adult Fish Trap negatively affect survival of natural spawning fish.
Hypothesis:
Ho: Handling fish at Tumwater Dam and the Off-ladder Adult Fish Trap does not affect post-release survival of fish spawning in the natural environment.

The Biological Opinion for the Priest Rapids Hydroelectric Project contains requirements for development and funding of an M&E program. Proposals will be reviewed and approved by the PRCC HSC, prior to review and approval by the PRCC and funded by Grant PUD. Habitat enhancement funds and monitoring dollars are also available through the Biological Opinion and Salmon and Steelhead Settlement Agreement.

Due to the critical role that M&E plays, efforts were initiated in 1997 with an adult monitoring plan. Juvenile monitoring was added in 2007. Current activities that support the M&E plan include: migrant trapping in the White River and Wenatchee River, adult trapping at Tumwater Dam, and spawning ground surveys in the White River (e.g., redd surveys and carcass recoveries). Other activities such as CWT and PIT tag recovery is also being done to assess survival, harvest, and straying. Furthermore, a relative reproductive success study funded by BPA will also contribute to knowledge about the performance of the hatchery program. It is anticipated that an ecological risk assessment (Pearsons and Hopley 1999) will be performed to identify if additional monitoring for NTTOC is needed.

Table 22. Field sampling for the White River spring Chinook salmon hatchery program M&E.

Task	Method	Location	Time	Sampling frequency	Data Collected
Adult migrant sampling	Adult trapping	Tumwater Dam	May-September	Daily	Date Count Length Origin Gender Scale sample Tissue sample Record mark and tag Apply tag
Adult spawning ground surveys	Walking surveys (redds and carcasses)	White River Nason Creek Little Wenatchee	August-September	Weekly	Redd count Redd date Redd location Carcass count Carcass date Carcass location Carcass gender Carcass length Carcass egg retention Record carcass mark and tag Carcass origin
Estimates of Adult harvest	Commercial, Tribal, and sport harvest surveys	Ocean Columbia R. Wenatchee R. Icicle	All year	Daily	Count Record mark and tag Location Scale
Broodstock sampling	Sampling broodstock at time of spawning	Nason Creek Hatchery or Little White Salmon NFH	August-September	Weekly	Date Count Length Origin Gender Scale sample Tissue sample Record mark and tag Fish health Egg weight
Juvenile migrant sampling	Rotary screw trap	White River Nason	March-November	Daily	Date Species Count Length

		Creek			Weight Record mark and tag Apply mark or tag Take scales Origin
In-Hatchery performance	Subsampling of abundance and size, Disease screening, tagging	White (Little White Salmon NFH, McComas) Nason (Nason Creek Hatchery)	All year	Generally monthly	Count Length Weight Fish health Tag or mark

The principles of adaptive management will be applied to the M&E program. As data are collected, as the recovery effort progresses, and as new science is developed, the program design will change to accommodate additional input. The PRCC HSC will be responsible for adapting the M&E program to new information. The flowchart below demonstrates how collected data is used to assess performance and make needed program changes.

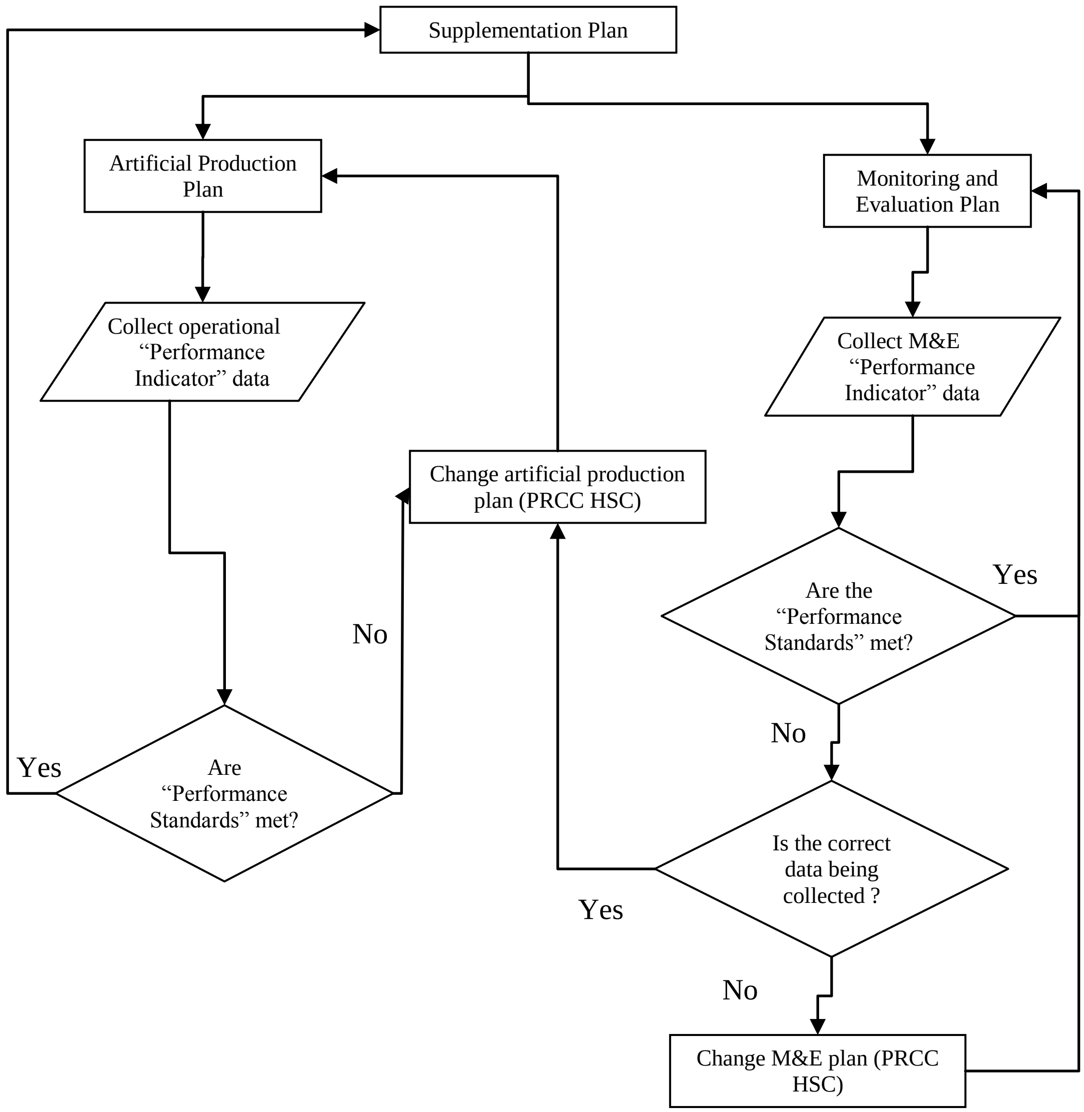

Figure 7. Adaptive management flow chart.

11.2) Risk aversion measures used to minimize adverse effects to listed fish.

Juvenile Monitoring: Injury to spring Chinook salmon, steelhead and Bull trout may occur through trapping, handling and marking procedures. Primary injury and mortality events are associated with debris accumulation in the live-box, reaction to anesthesia, handling stress, over-crowding in the live-box, predation in the live-box and increased predation post release. Injury and mortality will be minimized through diligent trap attendance. Traps will be checked a minimum of once a day in the morning or more often as needed. Injury and mortality associated with handling stress, anesthetizing and post release predation will be address by applying MS-222 to all fish handled and providing full recovery for fish prior to release. Other risk aversion measures include (see NOAA Fisheries 2007):

- No more than 20% of the natural or hatchery emigrants may be captured.

- Lethal take may not exceed 2% of the natural or hatchery fish captured.
- Tissue sampling shall be minimized to the extent possible.
- Fish must be kept in water to the maximum extent possible. Adequate water circulation and replenishment of water in holding units is required.
- Fish must be moved using equipment that holds water during transfer.
- Fish must not be handled if water temperatures exceed 69.8^{0}F at the capture site.
- The incidence of capture, holding, and handling effects shall be minimized and monitored.
- Visual observation protocols must be used instead of intrusive sampling methods whenever possible.

The Section 10 permit application (Grant PUD et al. 2006) and permit (NOAA Fisheries 2007) describe the risk aversion measures required of the current M&E activities associated with the juvenile-based captive brood phase. The juvenile M&E program is expected to be similar during the future adult capture based phase.

Adult Monitoring: No injury or mortalities are expected during the White River adult carcass and spawning ground surveys. Biological data and samples will be taken from only deceased spawned out fish. Field staff will minimize disturbance to any spawning spring Chinook salmon by identifying spawning sites and using a land route around their location.

The future adult trapping system may be used for M&E purposes. Protocols will be developed by the PRCC HSC for handling captured adults after the trapping method has been selected.

SECTION 12. RESEARCH

The program is not a research project.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this Hatchery Genetic Management Plan is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by______________________________ Date:_____________

ADDENDUM A. PROGRAM EFFECTS ON OTHER ESA-LISTED POPULATIONS.

This section will be the cornerstone for any required consultation with the U.S. Fish and Wildlife Service under section 7 of the ESA. Accordingly hatcheries that may affect any federally listed/ proposed aquatic or terrestrial species under USFWS jurisdiction need to complete this section. By fully addressing the topics of this section, the HGMP will provide the information necessary to initiate formal or informal consultation under the ESA for species under USFWS jurisdiction.

15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

Section 7 biological opinions, Section 10 permits, 4(d) rules, etc.

Biological opinion (BO) prepared in accordance with section 7 of the ESA:
USFWS Biological Opinion on the Effects of the Priest Rapids Hydroelectric Project Relicensing on Bull Trout (FERC No. 2114), March 14, 2007. USFWS Reference: 13260 -200 6-P -000 8, 1 3260 -2001 -F -0062

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

General species description and habitat requirements.
Local population status and habitat use.
Site-specific inventories, surveys, etc.

Bull trout (Salvelinus confluentus) are listed as threatened. See the Biological Opinion (BO) for a description of the habitat requirements and population status.

15.3) Analyze effects.

Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects, including duration and area of effects). Please focus analysis on the impact of hatchery program on listed/proposed species reproduction, numbers, and distribution.
Identify potential level of take (past and projected future).
<u>Consider the following</u>:
<u>Hatchery operations</u> – e.g., water withdrawals, effluent, trapping, releases, routine operations and maintenance activities, non-routine operations and maintenance activities (e.g. intake excavation, construction, emergency operations, etc.), grounds management, including herbicide/pesticide use.
<u>Fish health</u> – e.g., pathogen transmission, therapeutics, chemicals.
<u>Ecological/biological</u> – e.g., competition, behavioral, etc.
<u>Predation</u>
<u>M&E</u> – e.g., surveys (trap, seine, electrofish, snorkel, spawning, carcass, boat, etc.).
<u>Habitat</u> – e.g., modifications, impacts, quality, blockage, de-watering, etc.

The USFWS offers this conclusion (see the BO for details):
"Summary of the Effects of the White River Supplementation Plan. Although there will be adverse effects, the primary effect of this action may be beneficial, with the release of smolts increasing the density and availability of a seasonal prey base. However, water quality impacts, disturbance of Bull trout during spawning, and the accidental capture of Bull trout is likely to occur and may result in the modification of the behavior of Bull trout or injury. Impacts to the prey base can also be substantial when thousands of smolts are released and compete for the same resources other fish, including the Bull trout, are expected to use."

15.4 Actions taken to minimize potential effects.

Identify actions taken to minimize potential effects to listed species and their habitat.

The following suggestions were received in December of 2006 from David Morgan, biologist, US Fish and Wildlife Service. They will be considered for adoption in order to minimize impacts during egg and fry collection.

"Bull trout and spring Chinook spawning locations overlap in the lower White River between the Napeequa River and Panther Creek. Generally spring Chinook spawning begins shortly before Bull trout spawning, but spring Chinook eggs are not removed until several weeks later, after Bull trout spawning has ended. When spring Chinook eggs are extracted from these spawning areas, there is a risk that Bull trout redds could be affected. For example, eggs could accidentally be removed from Bull trout redds. It is critical to be certain that eggs are only removed from redds known to be made by spring Chinook.
The Service offers the following recommendations to minimize potential adverse effects to Bull trout in the White River during egg removal activities:

1. Crews from the agency or agencies conducting spring Chinook redd surveys should GPS the location of all redds believed to be made by spring Chinook. Sites that appear to be spring Chinook redds, but where spring Chinook were not actually observed, should be noted. Spring Chinook redds should be flagged so that when the Service begins Bull trout redds surveys in the same area, our crews will know the locations of potential egg removal sites for later that year.

2. To reduce the possibility that crews looking for spring Chinook will observe redds with no fish on them, these surveys should be conducted every day until the survey period ends. Eggs should not be removed from redds that spring Chinook have not been directly observed building or defending.

3. The Service will flag Bull trout redds, and note the locations where spring Chinook and Bull trout redds are close enough that there is increased risk of confusing the two.

4. After the Services third and final Bull trout redd survey, the Service will

communicate to the appropriate agency the locations where Bull trout redds and spring Chinook redds are closest. Instead of removing our flagging after the final Bull trout redd survey, our crews will leave some of the flags as needed. Potentially our crews could GPS these locations or other location information and share these files prior to egg removal.

5. In locations where redds of both species were observed within 10 m there would be no egg removal. [Note: the 10m distance recommendation will be evaluated and may not be applied when spring Chinook redds are downstream of Bull trout redds]

6. The Service will note if there were any locations where Bull trout may have superimposed their redds on top of existing spring Chinook redds, and share this information with the appropriate agency. Since Bull trout often do not linger on their redds, and might not be directly observed, if there is any doubt about possible redd superimposition (i.e. - evidence of new digging on a spring Chinook redd), these locations would not be used for egg collection.

The Service understands that the operational details of the White River hatchery program are still in the planning phase. Once the details of the program become known, the Service recommends that the over-arching program, including the egg removal in the White River, be the subject of ESA consultation under Section 7(a)(2), or Section 10(a)(1)(B)."

15.5 References

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as “fishery enhancement”.

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: dispensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as “supplementation”.

Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Major Population Group – sets of populations that share genetic, geographic (hydrographic), and habitat characteristics within an ESU.

Major Spawning Area (MaSa) – a system of one or more river reaches that contain sufficient habitat to support 500 spawners.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with natural origin recruit (NOR).

Natural origin recruit (NOR) - See natural fish.

Natural population - A spawning aggregate that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Supplementation - "…. the use of artificial propagation in an attempt to maintain or increase natural production, while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on non-target populations within specified biological limits." (RASP 1992)

Stock - (see "Population").

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations.

(generally from Washington Department of Fish and Wildlife, November, 1999).

SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	Grams/fish
Chinook Yearling	<=20	>=23
Chinook (Zero) Fingerling	>20 to 150	3 to <23
Chinook Fry	>150 to 900	0.5 to <3
Chinook Unfed Fry	>900	<0.5
Sockeye Yearling[1]	<=20	>=23
Sockeye Fingerling	>20 to 800	0.6 to <23
Sockeye Fall Releases	<150	>2.9
Sockeye Fry	> 800 to 1500	0.3 to <0.6
Sockeye Unfed Fry	>1500	<0.3
Steelhead Smolt	<=10	>=45
Steelhead Yearling	<=20	>=23
Steelhead Fingerling	>20 to 150	3 to <23
Steelhead Fry	>150	<3

[1] Sockeye yearlings defined as meeting size criteria and 1 year old.

Attachment 3. Estimated production.

Captive brood phase:

Captive brood performance assumptions			
	Goal	Average	Minimum
Egg/fry to adult survival	30%	20%	15%
Eggs/fry collected	1,500	1,500	1,500
Adults produced	450	300	225
Fecundity per female	1,160	1,160	1,160
Eggs produced	261,000	174,000	131,000
Egg to smolt survival	68%	68%	68%
Smolts produced	177,000	118,000	89,000
Smolt to adult survival	0.30%	0.30%	0.30%
Adult returns due to smolt release	531	354	267

Adult-based supplementation phase:

Supplementation performance assumptions (does not include 10% surplus)	
Brood collection	
Number of smolts released	150,000
Green egg to smolt survival	81%
Eggs taken	185,185
Fecundity per female	4,785
Adults spawned	77
Adult holding survival	90%
Adults collected	86
Adult production (1989-2001 BY data - Chiwawa hatchery)	
Smolt to adult survival - low value	0.04%
Adult returns due to smolt release - low value	54
Smolt to adult survival - high value	1.54%
Adult returns due to smolt release - high value	2,307
Smolt to adult survival - average value	0.51%
Adult returns due to smolt release - average value	758

Attachment 4. 2005 HCP broodstock collection protocols.

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
Mid-Columbia Field Office
3515 Chelan Hwy 97-A Wenatchee, WA 98801 (509) 664-1227 FAX (509) 662-6606

12 May 2005

To: Mid-Columbia HCP Hatchery Committee

From: Kirk Truscott

Subject: 2005 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-based Broodstock Collection Protocols.

Attached is the final version of the 2005 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-based Broodstock Collection Protocols. The document is essentially the same as the "Draft 2" version submitted to committee members on April 13, 2005; of which I received no comments. The substantive change in the final document is the inclusion of hatchery spring Chinook in the Chiwawa broodstock collection as agreed to in HCP hatchery Committee conference call on May 10, 2005.

Although HCP Hatchery Committee protocols identify 10 days notice of upcoming decision items for Committee action, WDFW would appreciate the Committee's consideration of a consensus agreement on this protocol at the May 18, 2005 HCP Hatchery Committee meeting (Decision Document provided).

If committee members have questions, please feel free to contact me.

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
Mid-Columbia Field Office
3515 Chelan Hwy 97-A Wenatchee, WA 98801 (509) 664-1227 FAX (509) 662-6606

12 May 2005

To: Mid-Columbia HCP Hatchery Committee

From: Kirk Truscott

Subject: FINAL 2005 UPPER COLUMBIA RIVER SALMON AND STEELHEAD BROODSTOCK OBJECTIVES AND SITE-BASED BROODSTOCK COLLECTION PROTOCOLS

This protocol was developed for hatchery programs rearing spring Chinook salmon, sockeye salmon, summer Chinook salmon, and summer steelhead associated with the mid-Columbia Habitat Conservation Plans (HCPs) and spring Chinook salmon and steelhead programs associated with the Biological Opinion for Section 7 Consultation of the Interim Operation for the Priest Rapids Hydroelectric Project (FERC No. 2114). These programs are funded by Chelan, Douglas, and Grant County Public Utility Districts (PUDs) and are operated by the Washington Department of Fish and Wildlife (WDFW). Additionally, the Yakama Nation's Coho Reintroduction Program broodstock collection protocol, when provided by the Yakama Nation, will be included in this protocol because of the overlap in trapping dates and locations.

This protocol is intended to be a guide for 2005 collection of salmon and steelhead broodstocks in the Methow, Wenatchee, and Columbia River basins and was developed using run estimates calculated by WDFW. It is consistent with previously defined program objectives such as program operational intent (i.e., conservation and/or harvest augmentation), production level targets, and to comply with ESA permits. This protocol may be adjusted in-season based on actual run monitoring at mainstem dams and other sampling locations.

Above Wells Dam

Spring Chinook
Pre-season estimates have 4,573 spring Chinook destine above Wells Dam, 33% or 1,528 are expected to be natural origin. In-season estimates of natural origin spring Chinook to individual tributaries will be adjusted proportional to the estimated returns detailed in Table 2 of the 2005 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast and the total spring Chinook passage at Wells Dam at the 50% and 75% passage dates. Natural origin fish inclusion into the broodstock will be a priority,

with natural origin fish specifically being targeted; however, natural origin fish collections will not exceed 33% of the in-season estimated return to any tributary spawning population. All hatchery origin fish retained for broodstock will be adipose present coded-wire tagged.

The Methow Fish Hatchery (FH) rears spring Chinook salmon for three acclimation/release sites on three tributaries of the Methow River; Twisp, Chewuch and Methow Ponds. The total production level target is 550,000 smolts divided equally among the three release sites (183,000 smolts per site).

Broodstock will be collected at the Methow FH outfall and at tributary traps on the Methow, Chewuch, and Twisp rivers. The Twisp Pond release group is limited to releasing progeny of broodstock collected from the Twisp River. The Chewuch Pond prioritizes progeny of Chewuch River collected broodstock, but may include progeny of broodstock collected from the Methow River. Based on these limitations and the assumptions listed below (Table 1), the following broodstock collection protocol was developed.

Table 1. Assumptions and calculations to determine number of broodstock needed for each tributary release of 183,000 smolts.

Smolt release		183,000	Smolt release goal
Fertilization-to-release survival	90%	203,333	
ELISA adjustment	15%	35,882	Eggs
Eggtake Target		239,215	Eggs
Fecundity	4,200	57	Females
Female to male ratio	1 to 1	114	
Pre-spawn survival	95%	120	Broodstock collection target

For the Twisp Pond program, up to 120 spring Chinook salmon may be collected at the Twisp River weir. Trapping will begin on 01 May and is expected to be completed by 06 August. Salmon will be retained across the run, proportionally consistent with estimated run timing. No more than 33% of the natural origin run will be retained for broodstock. The trap schedule will include a 4-days up and 3- days down sequence. Once the weekly retention target is reached, trapping will cease until the beginning of the next week. If a shortfall occurs in the weekly trapping quota, the shortfall will carry forward to the following weeks collection quota. The weir will be manned 24-hours/day during trapping days to facilitate operation to minimize impact to steelhead kelts and spring Chinook fallback. If the new weir design and operation cannot adequately address kelt migration or spring Chinook fallback, trapping will cease and the weir removed.

For the Chewuch Pond program, a total of 120 spring Chinook salmon are needed for broodstock. Collection activities will begin 01 May and are expected to be complete by 06 August. Up to 120 spring Chinook salmon may be collected from the Chewuch River at Fulton Dam. The dam does not block migrating fish and the trap is anticipated to have a low capture rate. The WDFW will also attempt to seine broodstock once a week at locations determined to be effective and where fish can be safely transported to Methow FH. Angling will be used as a last resort if all other methods do not provide adequate broodstock. No more than 33% of the natural origin return will be retained for broodstock. In the event that sufficient broodstock for the Chewuch Program cannot be attained from the Chewuch River, salmon will be collected from the Methow River as described below.

The Methow Pond program requires 120 broodstock. These will be collected at the Foghorn Dam on the Methow River in combination with the Methow FH outfall to meet the broodstock target. Trapping will begin on 01 May and is expected to be completed by 06 August. Weekly collection targets will be followed to collect from throughout the run. Once the weekly retention target is reached, all salmon will be released until the beginning of the next week. If the Chewuch Pond program is short on broodstock, then the weekly collection target may be adjusted to fill both the Methow and Chewuch broodstock targets.

Steelhead

Steelhead mitigation programs above Wells Dam utilize adult broodstock collections at Wells Dam and incubation/rearing at Wells Fish Hatchery (FH). Based on mitigation program production objectives (Table 2) and program assumptions (Table 3), the following broodstock collection protocol was developed.

Table 2. Production objectives for programs supported through adult steelhead broodstock collections at Wells Dam.

Program	# Smolts	# eyed eggs	% Wild	# Wild	# Hatchery	Total Adults
DCPUD [1/]	349,000	401,149	33%	59	119	178
GCPUD [1/]	100,000	114,943	33%	17	34	51
USFWS [1/]	100,000	125,000	33%	18	37	55
Sub-Total	**549,000**	**641,092**	**33%**	**94**	**190**	**284**
Ringold	180,000	240,000	0%	0	105	105
Sub-Total	**180,000**	**240,000**	**0%**	**0**	**105**	**105**
Grand Total [2/]	**729,000**	**881,092**	**24%**	**94**	**295**	**389**

[1/]- Above Wells Dam releases. Target HxW parental adults as the hatchery component

[2/]- Based on steelhead production consistent with Mid Columbia HCP's, GCPUD BiOp and Section 10 Permit 1395.

[3/]- Based on adults required for eyed egg allotment

Trapping at Wells Dam will selectively retain 389 steelhead (east and west ladder collection). The collection will retain no greater than 33% natural origin broodstock for the mitigation programs and 100% hatchery origin within the Ringold FH production component. Overall collection will be limited to no more than 33% of the natural origin return may be retained for broodstock. The east and west ladder trapping at Wells Dam will begin on 01 August and terminate by 31 October and will be operated concurrently three days per week, up to 16 hours per day, if required to meet broodstock objectives. Trapping on the east ladder will be concurrent with summer Chinook broodstocking efforts through 14 September and will continue through 31 October, concurrent with west ladder steelhead collections. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and Wells dams. Broodstock collection adjustments may be made based on in-season monitoring and evaluation.

Table 3. Program assumptions used to determine adult collection required to meet steelhead production objectives for programs above Wells Dam and at Ringold Springs Fish Hatchery.

Program assumption	Standard
Pre-spawn survival	97%
Female to male ratio	1.0 : 1.0
Fecundity	5,400
Propagation survival	
87% fertilization to eyed egg	87%
86% eyed egg to yearling release	86% [1/]
75% fertilization to yearling release	75% [1/]

[1/]- Not applicable to Ringold Springs Fish Hatchery

Summer/fall Chinook

Summer/fall Chinook mitigation programs above Wells Dam utilize adult broodstock collections at Wells Dam and incubation/rearing at Eastbank Fish Hatchery (FH). The total production level target is 976,000 summer/fall Chinook smolts for two acclimation/release sites on the Methow and Similkameen rivers (Carlton Pond and Similkameen Pond, respectively). Current return projections estimate approximately 13,000 natural origin summer/fall Chinook to migrate past Wells Dam during 2005, providing a high probability of collecting 100% natural origin fish in the broodstock. Review of recent summer/fall Chinook run timing past Wells Dam indicates previous years broodstock collection activities omitted the later returning summer/fall Chinook. In an effort to incorporate broodstock that better represent the summer/fall Chinook run timing past Wells Dam, the broodstock collection will extend to the third week of September, concurrent with steelhead collections from the east ladder trap. In-season estimates of natural origin Chinook to Wells Dam will be adjusted proportional to the estimated returns detailed in Table 2 of the 2005 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast and the total summer/fall Chinook passage at Wells Dam at the 50% and 75% passage dates. Based on initial run projections, program objectives and program assumptions (Table 5); the following broodstock collection protocol was developed.

Table 5. Assumptions and calculations to determine number of broodstock needed for summer/fall Chinook production at Carlton and Similkameen ponds.

Program Assumption		**Carlton Pond**	**Similkameen Pond**	**Total**
Smolt release		**400,000**	**576,000**	**976,000**
Fertilization-to-release survival	90%			
Eggtake Target		**512,821**	**738,462**	**1,251,282**
Fecundity	5,000			
Female target		**103**	**147**	**250**
Female to male ratio	1 to 1			
Broodstock target		**206**	**294**	**500**
Pre-spawn survival	90%			
Total collection target		**229**	**327**	**556**

WDFW will retain 556 natural origin summer/fall Chinook at Wells Dam east ladder. Collection will be proportional to return timing between 01 July and 14 September. Trapping will occur 3-days/week, 16 hours/day. The 3-year old component will be limited to 10% of the broodstock collection. If the probability of achieving the broodstock goal is reduced based on the estimated escapement levels, broodstock composition will be adjusted to meet the broodstock collection objective. No more than 33% the natural origin run will be retained for broodstock.

Table 6. Assumptions and calculations to determine number of broodstock needed for summer/fall Chinook production at Wells and Turtle Rock Island hatcheries.

	Standard		Wells FH		Turtle Rock FH		Lake Chelan [1/]	Total		
Program Assumption	Sub-year.	Year.	Sub-year.	Year.	Sub-year.	Year.	eye-egg	Sub-year.	Year.	Total
Smolt release			484,000	320,000	1,078,000	200,000	NA	1,562,000	520,000	2,082,000
Fertilization-to-release survival	81%	78%					NA			
Eggtake Target			597,531	410,256	1,330,864	256,410	100,000	1,928,395	666,667	2,695,062
Fecundity	5,000	5,000								
Female target			120	82	266	51	20	386	133	539
Female to male ratio	1 to 1	1 to 1								
Broodstock target			240	164	532	102	40	772	266	1,078
Pre-spawn survival	90%	90%								
Total collection target			267	182	591	113	44	858	296	1,198

[1/]- Lake Chelan eggs will be incorporated into the last egg take and incubated at Wells Hatchery until eyed stage and then shipped to the Lake Chelan RSI program.

Columbia River Mainstem below Wells Dam

WDFW will collect 1,198 run-at-large summer Chinook including 1,077 hatchery fish from the volunteer ladder trap at Wells Fish Hatchery outfall and 121 natural origin fish from the Wells Dam west ladder. West ladder collections will begin 01 July and completed by 14 September and will be consistent with run timing past Wells Dam. Due to fish health concerns associated with the volunteer collection site, the volunteer collection will begin 10 July and terminate by 31 August, or when the summer Chinook broodstock collection objective is met, which ever is earliest. The 3-year old component will be limited to 10% of the broodstock collection to minimize the retention of surplus males.

Coho
Yakama Nation will provide broodstock collection objectives for the Coho reintroduction program in the Methow River basin. WDFW will work collaboratively with the Yakama Nation to facilitate Coho collections at Wells Dam.

Wenatchee River Basin

Spring Chinook
Pre-season estimates have 6,111 spring Chinook destine for the Chiwawa River, 56% or 3,445 are expected to be natural origin. In-season estimates of natural origin Chinook to the Chiwawa River will be adjusted proportional to the estimated returns detailed in Table 2 of the 2005 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast and the total spring Chinook passage at Tumwater Dam at the 25%, 50% and 75% passage dates. Spring Chinook returns to the Columbia River through 09 May were approximately 20% of the pre-season forecast. The Technical Advisory Committee (TAC) has revised the projected total return estimated at 73,000-88,000 fish or approximately 33% of the pre-season forecast.

The Eastbank Fish Hatchery (FH) rears spring Chinook salmon for the Chiwawa River acclimation pond located on the Chiwawa River. The 2005 BY total production level target is 672,000 smolts.1/ Natural origin fish inclusion into the broodstock will continue to be a priority, with natural origin fish specifically being targeted. Natural origin fish collections will not exceed 33% of the in-season estimated return to the Chiwawa River and will provide, at a minimum, 33% of the total broodstock retained. Based on these limitations and the assumptions listed below (Table 7), the following broodstock collection protocol was developed.

Table 7. Assumptions and calculations to determine number of broodstock needed for Chiwawa program release of 672,000 smolts.

Program Assumption	Standard	Chiwawa program
Smolt release		**672,000**
Fertilization-to-release survival	83%	
Eggtake Target		**809,639**
Fecundity	4,400	
Female target		**184**
Female to male ratio	1 to 1	
broodstock target		**368**
Pre-spawn survival	97%	
Total broodstock collection		**379**

WDFW will retain 379 natural and coded-wire tagged hatchery origin spring Chinook from Tumwater Dam and the Chiwawa weir. Initially, 40 coded-wire tagged hatchery origin Chinook will be retained from Tumwater Dam. No additional hatchery origin Chinook will be retained at Tumwater Dam or Chiwawa weir until 20 natural origin Chinook have been retained at the Chiwawa weir. In-season assessment of the magnitude and composition of the spring Chinook return above Tumwater Dam will be used to determine the appropriate number of coded-wire tagged hatchery origin fish to include in the broodstock, consistent with a minimum 33% natural origin composition in the broodstock.

Trapping at Chiwawa weir will begin 01 June and terminate no later than 10 September. Spring Chinook trapping at the Chiwawa weir will follow a 4-days up and 3-days down schedule, consistent with weekly broodstock collection quotas that approximate the historical run timing and a maximum 33% retention of the projected natural origin escapement to the Chiwawa River.

1/- Based on concurrence (agreement/decision) in the Chelan HCP Hatchery Committee, outyear production may be reduced to 298,853 yearling smolts.

If the weekly quota is attained prior to the end of the 4-day trapping period, trapping will cease. If the weekly quota is not attained within the 4- day trapping period, the shortfall will carry forward to the next week. Retention of coded-wire tagged hatchery origin spring Chinook at Tumwater Dam will begin 16 May and will be concurrent with the trapping efforts associated with the Spring Chinook Reproductive Success Program. Spring Chinook retained will be transferred to Eastbank Fish Hatchery (FH) for holding in well water.

All Bull trout trapped at the Chiwawa weir will be transported by tank truck and released into a resting/recovery pool at least 1.0 km upstream from the Chiwawa River weir.

Steelhead

Current estimated upper Columbia River steelhead run size is sufficient to provide the 208 adult steelhead broodstock required to meet the Wenatchee basin production objective of 400,000 smolts. The steelhead mitigation program in the Wenatchee basin use broodstock collections at Dryden and Tumwater dams located on the Wenatchee River. Broodstock collection will target 50% natural origin fish and 50% hatchery origin fish, not to exceed 33% of the natural origin steelhead return to the Wenatchee basin. Based on these limitations and the assumptions listed below (Table 8), the following broodstock collection protocol was developed.

Table 8. Assumptions and calculations to determine number and origin of adult steelhead needed for Wenatchee Basin Steelhead program release of 400,000 smolts.		
Program Assumption	**Standard**	**Wenatchee program**
Smolt release		**400,000**
Fertilization-to-release survival	75%	
Eggtake Target		**533,333**
Fecundity	5,400	
Female target		**99**
Female to male ratio	1 to 1	
broodstock target		**198**
Pre-spawn survival	95%	
Total broodstock collection		**208**
Natural : hatchery ratio	1 to 1	
Natural origin collection total		**104**
Hatchery origin collection total		**104**

WDFW will retain 208 mixed origin, steelhead at Dryden and Tumwater dams. Collection will be proportional to return timing between 01 July and 12 November. Collection may also occur between 13 November and 3 December at both traps, concurrent with the Yakama Nation Coho broodstock collection activities. To attain weekly broodstock collection objectives, Dryden Dam may be operated 7-day/week, 24-hours/day and Tumwater Dam may be operated 3-days/week, up to 16-hours/day. Hatchery x hatchery parental cross, and unknown hatchery parental cross adults will be excluded from the broodstock collection. Hatchery steelhead parental origins will be determined through evaluation of VIE tags during collection.

In the event that steelhead collections fall substantially behind schedule, WDFW may capture some adult steelhead from the mainstem Wenatchee River by hook and line. Prior to hook and line collections, the JFP will be notified. In addition to trapping and hook and line collection efforts, Tumwater Dam may be operated between February and early April to supplement broodstock numbers if the fall trapping effort provides fewer than 208 adults.

Summer/fall Chinook

Summer/fall Chinook mitigation programs in the Wenatchee River basin utilize adult broodstock collections at Dryden and Tumwater dams, incubation/rearing at Eastbank Fish Hatchery (FH) and acclimation/release from the Dryden Acclimation Pond. The total production level target is 864,000 smolts.

Current return projections estimate approximately 8,500 natural origin summer/fall

Chinook will return to the Wenatchee basin during 2005, providing a moderate/high probability of collecting 100% natural origin fish in the broodstock. Review of recent summer/fall Chinook run-timing past Dryden and Tumwater dam indicates that previous broodstock collection activities have omitted the early returning summer/fall Chinook, primarily due to limitations imposed by ESA Section 10 Permit 1347 to minimize impacts to listed spring Chinook. In an effort to incorporate broodstock that better represent the summer/fall Chinook run timing in the Wenatchee basin, the broodstock collection will front-load the collection to account for the disproportionate collection timing. Approximately 43% of the summer/fall Chinook passage to the upper basin occurs prior to the end of the first week of July; therefore, the collection will provide 43% of the objective by the end of the first week of July. Weekly collection after the first week of July will be consistent with run timing of summer/fall Chinook during the remainder of the trapping period. Collections will be limited to a 33% extraction of the estimated natural origin escapement to the Wenatchee basin. Based on these limitations and the assumptions listed below (Table 9), the following broodstock collection protocol was developed.

Table 9. Assumptions and calculations to determine number of summer Chinook broodstock needed for Wenatchee Basin program release of 864,000 smolts.

Program Assumption	Standard	Wenatchee program
Smolt release		**864,000**
Fertilization-to-release survival	78%	
Eggtake Target		**1,107,692**
Fecundity	5,000	
Female target		**221**
Female to male ratio	1 to 1	
broodstock target		**442**
Pre-spawn survival	90%	
Total broodstock collection		**492**

WDFW will retain 492-natural origin, summer Chinook at Dryden and Tumwater dams. Trapping at Dryden Dam will begin 01 July and terminate no later than 31 August and operate up to 7-days/week, 24-hours/day. Trapping at Tumwater Dam may begin 15 July and terminate no later than 31 October and operate 3-days/week, 8-hours/day. Up to 25% (123) of the total broodstock collection may occur at Tumwater Dam. No selection for male or female will occur during collection with the exception of limiting the 3-year old component to 10% of the broodstock total.

If the probability of achieving the broodstock goal is reduced, based on the estimated escapement levels, broodstock composition will be adjusted to meet the broodstock collection objective of 492 fish.

Sockeye

Sockeye Salmon mitigation in the Wenatchee River basin utilizes adult broodstock collections at Tumwater Dam, incubation/rearing at Eastbank Fish Hatchery (FH) and rearing/pre-smolt releases from the net pens in Lake Wenatchee. The total production level for the 2005 BY is 200,000 pre-smolts. [1/]

Current return estimates have approximately 30,000 Lake Wenatchee sockeye returning to the Columbia River in 2005, providing a high probability of maintaining a broodstock collection goal of 100% natural origin fish. Based on projected return, 100% natural origin broodstock composition and assumptions listed below (Table 10), the following broodstock collection protocol was developed.

Table 10. Assumptions and calculations to determine number of sockeye salmon broodstock needed for Wenatchee Basin program release of 200,000 pre-smolts.

Program Assumption	Standard	Wenatchee program
Smolt release		**200,000**
Fertilization-to-release survival	80%	
Eggtake Target		**250,000**
Fecundity	2,594	
Female target		**97**
Female to male ratio	1 to 1	
broodstock target		**194**
Pre-spawn survival	89%	
Total broodstock collection		**218**

WDFW will retain 218 natural origin sockeye, proportional to run timing at Tumwater Dam. Due to the unequal sex ratio in previous years, attempts will be made to collect an equal number of males and females. Trapping may begin on 15 July and terminate by 15 August. Trapping will occur no more than 3-days/week, 8- hours/day.

If the probability of achieving the broodstock goal is reduced, based on the estimated escapement levels, broodstock number and composition will be adjusted consistent the retention of 218 sockeye with no more than 10% of the broodstock composed of adipose absent hatchery origin fish and an overall broodstock collection of no more than 10% of the total return past Tumwater Dam.

Coho

Yakama Nation will provide broodstock collection objectives and program assumptions for the Coho reintroduction program in the Wenatchee River basin. WDFW will work collaboratively with the Yakama Nation to facilitate Coho broodstock collections at Dryden and Tumwater dams.

[1/]- Chelan HCP Hatchery Committee has agreed to future production level of 280,000 fish, pending appropriate infrastructure improvements.

Attachment 5. Acronyms.

AHA – All-H Analyzer
BAMP - Biological Assessment and Management Plan
BKD - Bacterial Kidney Disease
BO - Biological Opinion
BY - Brood Year
CFS - Cubic Feet per Second
CRFMP - Columbia River Fish Management Plan
CRITFC – Columbia River Intertribal Fish Commission
CWT - Coded Wire Tag
DNA - Deoxyribonucleic Acid, Genetic Information
ESA - Endangered Species Act
ELISA - Enzyme-Linked Immunosorbent Assay
ESU - Evolutionarily Significant Unit
FERC - Federal Energy Regulatory Commission
FFP – Fish/pound
FI – Flow Index
F2 – second generation
gpm – gallons per minute
USFWS - U.S. Fish and Wildlife Service
HOB – Hatchery Origin Broodstock
HOR – Hatchery Origin Recruit
HOS – hatchery Origin Spawner
HSRG – Hatchery Scientific Review Group
HCP - Habitat Conservation Plan
ICRT – Interiior Columbia Technical review Team
IEAB - Independent Economic Analysis Board
IHOT – Integrated Hatchery Operations Team
ISAB - Independent Scientific Advisory Board
JFP - Joint Fisheries Parties
MaSa – Major Spawning Area
MiSa – Minor Spawning Area
NEPA - National Environmental Policy Act
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
NOB – Natural Origin Broodstock
NOR – Natural Origin Recruit
NOS – Natural Origin Spawner
NPDES – National Pollutant Discharge Elimination System
NNI - No Net Increase
pHOB – Proportion as HOB
pHOS – Proportion as HOS
PIT - Passive Integrated Transponder
PNFHPC - Pacific Northwest Fish Health Protection Committee
PNI – Proportionate Natural Influence
pNOB – Proportion as NOB

pNOS – Proportion as NOS
PRCC – Priest Rapids Coordinating Committee
PRCC HSC – Priest Rapids Coordinating Committee Hatchery Sub-Committee
PSM – Pre-Spawn Mortality
PUD - Public Utility District
RM - River Mile
RPA – Reasonable and Prudent Actions
SAR - Smolt-To-Adult Return Rate
SSHIAP - Salmon and Steelhead Habitat Inventory and Assessment Project
TRT - Technical Recovery Team
UCR - Upper Columbia Region
UCRSRB - Upper Columbia River Salmon Recovery Board
UCRSRP – Upper Columbia River Salmon Recovery Plan
VI - Volume Index
VSP - Viable Salmonid Population
WDFW - Washington Department of Fish and Wildlife
WDOE - Washington Department of Ecology
WRIA - Watershed Resource Inventory Area
YKFP – Yakima Klickitat Fisheries Project
YN – Confederated Tribes and Bands of the Yakama Nation

Attachment 6. Take Table. Estimated listed salmonid take levels by activity.

Spring Chinook:

Listed species affected: O. tshawytscha; ESU/Population: Upper Columbia River (UCR) spring Chinook ; Activity: White River Supplementation Program				
Location of hatchery activity: Little White Salmon NFH, various Wenatchee basin locations; Dates of activity: Year-round; Hatchery program operators: WDFW, USFWS, YN				
Type of Take	Annual Maximum Take of Listed Fish By Life Stage (% of Run or Number of Fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			100% [W] - M&E (see section 11).	100% [W]
Collect for transport b)				
Capture, handle, release c)				
Capture, handle, tag/mark/tissue sample, release d)		• 165,000[W] - hatchery marking and release (see section 9). • 20% [W] hatchery and 20% [W] natural origin –trapping and marking migrants (see #1592).	85% [W] natural origin at PRD and up to 100% passing Tumwater Dam – M&E and origin identification for brood collection (see section 7).	100% [W]
Removal (e.g. broodstock) e)	1,500[W] eyed eggs or fry (see #1592)		100 [W] – broodstock collection (see section 6).	
Intentional lethal take, including adult removal necessary to manage hatchery escapement to spawning grounds (PNI) f)		30/1,000[UCR] hatchery and 30/1,000 [UCR] natural origin – research (see #1482).	• 100% [W] hatchery origin adults – PNI management (see section 7). • 10 [UCR] hatchery and 10 [UCR] natural origin – research (see #1482).	
Unintentional lethal take g)		• 1,000 [UCR] hatchery and 1,000 [UCR] natural origin – research (see #1482). • 2% [W] natural and hatchery migrants (see #1592).	1/10 [UCR] hatchery and 1/10 [UCR] natural origin – research (see #1482).	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at traps or weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs, or broodstock collection strategies.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.
[W]. White River stock only.
[UCR]. UCR spring Chinook population. Takes are for all activities impacting the population, the portions of the take allowed by the White River program alone have not been calculated.

Takes are authorized through Section 10 permits #1592 for operation of the White River supplementation program and #1482 for research activities in the basin (see section 2.1). These permits are subject to change during periodic renewals and through the annual authorization process.

Steelhead: Listed species affected: O. mykiss; ESU/Population: Upper Columbia River (UCR) Steelhead; Activity: White River Supplementation Program.				
Location of hatchery activity: Little White Salmon NFH, various Wenatchee basin locations; Dates of activity: Year-round; Hatchery program operators: WDFW, USFWS, YN				
Type of Take	Annual Maximum Take of Listed Fish By Life Stage (% of Run or Number of Fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, release c)				
Capture, handle, tag/mark/tissue sample, release d)		20%[W] full population - enumeration and sampling (see #1592).		
Removal (e.g. broodstock) e)				
Intentional lethal take, f)			10 [UCR] hatchery and 10 [UCR] natural origin – research (see #1482).	
Unintentional lethal take g)		• 1,000[UCR] hatchery and 1,000 [UCR] natural origin - research (see #1482). • 1% [W] trapped - enumeration and sampling (see #1592).	1 unintentional mortality/10 [UCR] encounters of hatchery and 1/10 [UCR] natural origin – research (see #1482).	
Other Take (specify) h)				

[W]. White River stock only.
[UCR]. UCR steelhead population. Takes are for all activities impacting the population, the portions of the take allowed by the White River program alone have not been calculated.

Takes of UCR steelhead are authorized through Section 10 permits #1592 for operation of the White River supplementation program and #1482 for research activities in the basin (see section 2.1). These permits are subject to change during periodic renewals and through the annual authorization process.